# Correcting Upper Eyelid Retraction by Means of Pretarsal Levator Lengthening for Complications following Ptosis Surgery

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**Background:** Eyelid retraction is a condition in which the upper eyelid ascends past its ideal position, 1 to 2 mm below the upper limbus of the cornea. This condition can be a result of overcorrecting ptosis, hyperthyroidism, and other causes. The authors present studies conducted on eyelid retraction caused by ptosis overcorrection. An innovative approach for levator lengthening using the pretarsal tissue as a spacer flap is introduced as a method to correct the retraction.

**Methods:** A series of 60 patients over a 6-year period underwent 71 eyelid procedures to correct upper lid retraction following upper blepharoplasty and ptosis repair. All eyelid retractions ranged from 1 to 3 mm above its ideal position. All eyelids were corrected with the authors' technique of lengthening the levator with pretarsal tissue. Twelve cases that required further lengthening were completed by creating a superiorly based rotation flap.

**Results:** Of the 71 cases, 61 (86 percent) observed favorable results, six (8 percent) attained mild ptosis after surgery, and four (6 percent) regained upper eyelid retraction. All of the unsuccessful cases were corrected through early revision surgery, more advancement for the ptosis, and further recess or rotation flap for the retraction. No other complications were observed, except formation of supratarsal fold asymmetry, which was corrected through minor revision surgery.

**Conclusions:** It is very difficult to correct eyelid retraction caused by tissue fibrosis and muscle degeneration. Correction of the retraction by levator lengthening using the pretarsal tissue is simpler to execute, measurable during surgery, and easy to adjust, and offers high predictability in its result. (*Plast. Reconstr. Surg.* 130: 73, 2012.)

**CLINICAL QUESTION/LEVEL OF EVIDENCE:** Therapeutic, IV.


Many people of East Asian descent—mainly Korean, Chinese, and Japanese—desire upper double-eyelid folds. Among them, many people who have vertical height of the palpebral fissure below average desire larger eyes. Therefore, a ptosis procedure is performed during double-eyelid surgery. Despite the usefulness of ptosis correction, there is a possibility for complications, including eyelid retraction. Retraction is relatively difficult to correct and currently stands as an ongoing challenge for plastic surgeons. The upper eyelid is considered to be in its ideal position when its margin covers 1 to 2 mm of the upper limbus of the cornea. An eyelid that ascends higher is considered to retract.

If the retraction is severe enough to expose the sclera, the eyes appear unnatural. Unilateral eyelid retraction can also occur, which accentuates the unnatural appearance. Furthermore, eyelid retraction often causes lagophthalmos, dry eye syndrome, and exposure keratopathy. Therefore, correction of retraction is necessary for both cosmetic and functional purposes.

One of the main causes of eyelid retraction is hyperthyroidism. Currently, the techniques used to correct retraction vary from levator recession to

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spacer grafts; most of the techniques relate to retraction caused by hyperthyroidism. The prior techniques were usually challenging to execute and therefore required immense skill and precision. Our technique uses pretarsal soft tissue to lengthen the levator to make the correction more manageable and complete.

## PATIENTS AND METHODS

Our retraction correction technique was performed on 60 patients who had iatrogenic eyelid retraction—11 bilateral and 49 unilateral—between February of 2005 and January of 2011. The age of the patients ranged from 12 to 56 years, averaging 35 years. The follow-up period ranged from 1 to 72 months, averaging 26 months. The standard position of the normal upper eyelid was established to 1 to 2 mm below the upper limbus in neutral perspective; any level higher than the standard position of the cornea was diagnosed as upper eyelid retraction. The eyelid retraction ranged from 1 to 3 mm, averaging 2.1 mm, above the upper limbus. There were a total of 71 cases where iatrogenic retraction was corrected with our technique, which lengthens the levator using pretarsal tissue. Of the 71 cases, 12 required further lengthening, which was completed by creating a superiorly based rotation flap (Table 1).

**Table 1. Patient and Case Information**

| Characteristic | Value |
|---|---|
| Sex | |
| Male | 3 |
| Female | 57 |
| Total | 60 |
| Operative case, no. of cases | |
| Unilateral | 49 |
| Bilateral | 11 |
| Total | 60 |
| Age, yr | |
| Minimum | 12 |
| Maximum | 56 |
| Average | 34.8 |
| Previous operative number | |
| Minimum | 1 |
| Maximum | 4 |
| Average | 1.5 |
| Retraction range, mm | |
| Minimum | 1 |
| Maximum | 3 |
| Average | 2.1 |
| Follow-up period, mo | |
| Minimum | 1 |
| Maximum | 72 |
| Average | 25.5 |
| Operative method, no. of cases | |
| Lengthening only | 59 |
| Rotation flap used | 12 |
| Total | 71 |

### Surgical Techniques

Minimal local anesthesia was placed into the eyelid under light sedation without distorting the eyelid's anatomical dimension. A mixture of 1% lidocaine and epinephrine (1:100,000) was injected with a 30-gauge needle into the subcutaneous tissue, and a regional nerve block was made 1 cm above the supraorbital foramen to block the supraorbital and supratrochlear nerves with 1 to 2 ml of local solution. Throughout the operation, the patient cooperated by opening and closing their eye repeatedly to establish ideal eyelid height. During the operation, lidocaine without epinephrine was injected, and an incision was made in the skin and orbicularis muscle to expose the septum, and dissection was performed between the septum and aponeurosis to expose the aponeurosis. To lower the eyelid, the pretarsal levator–Müller muscle complex including scar tissue was separated from the tarsus in a cephalad direction. The level of this detachment was set 4 to 5 mm below the upper edge of the tarsus. The dissection was continued upward to expose the conjunctiva. The anesthetic eyedrop was introduced into the eye and saline was infiltrated into subconjunctival space to help facilitate the dissection. No change in eye size was confirmed before detachment from the conjunctiva. The changes resulting from anesthesia or edema were taken into consideration for the final height determination. The detached levator-Müller complex was altogether elevated from the conjunctiva. During the separation process, the eye size was monitored simultaneously to ensure that a ptotic state was achieved. Then, the operation proceeded to the ptosis surgery. The lengthened pretarsal tissue was sutured to the upper border of the tarsal plate with 7-0 nylon. The height of the eyelid was set 1 mm higher than the desired height to compensate for postoperative eyelid descent caused by loosening of sutured tissue. After adjusting the eyelid to its desired position, a double-eyelid crease was created, secured with 7-0 polydioxanone, and skin was closed with 7-0 nylon (Figs. 1 and 2). In the majority of cases, this technique was sufficient for lengthening the levator muscle for retraction correction (Fig. 3). However, in 12 cases of relatively severe retraction of the pretarsal tissue could not be sufficiently lengthened, a hockey-stick incision was made on the pretarsal tissue to create a superiorly based rotation flap. This maneuver lengthened the pretarsal tissue by an additional 2 to 4 mm (Fig. 4).

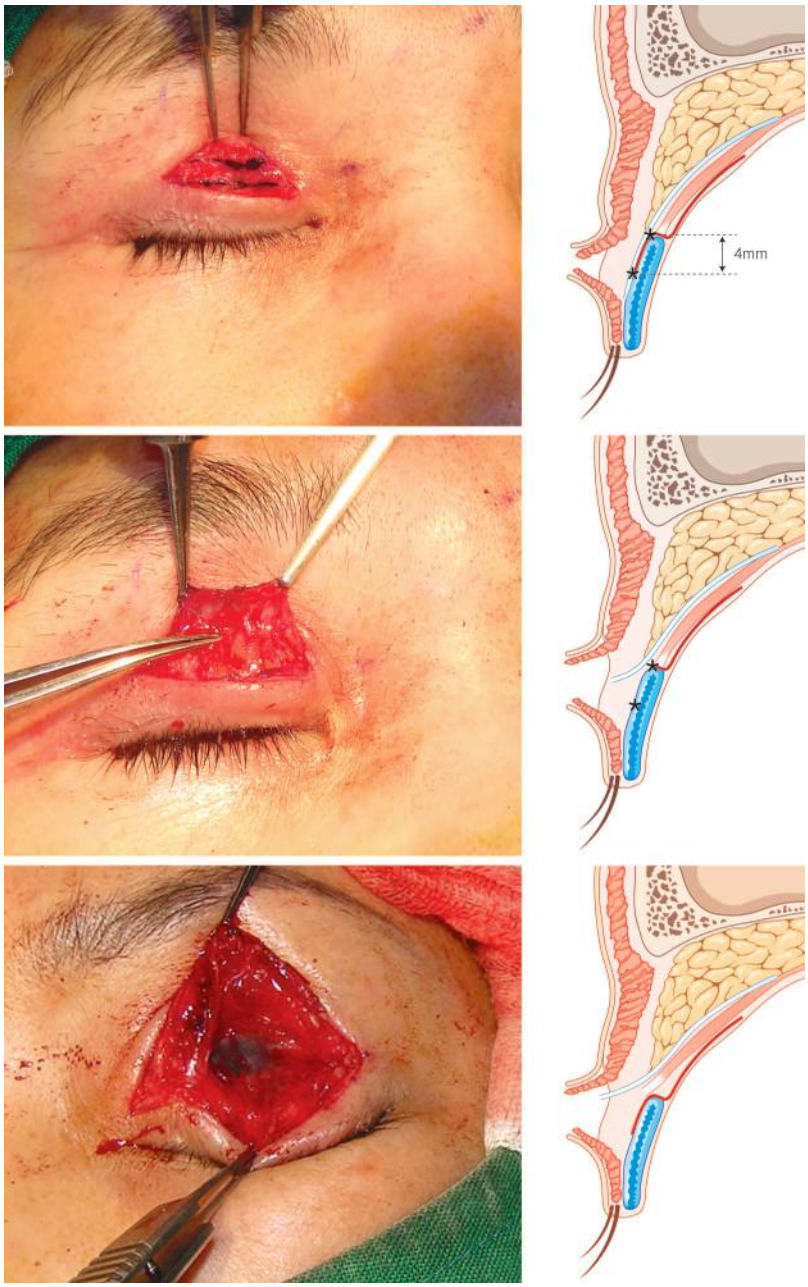


**Fig. 1.** Correcting upper eyelid retraction. (*Above*) The starting point for pretarsal tissue elevation in the superior tarsal edge (*upper line*), and for 4 mm below the superior tarsal edge (*lower line*). (*Center*) Elevation of pretarsal tissue from the tarsus by creating a 4-mm flap. (*Below*) Separation of the Müller muscle from the conjunctiva after hydrodissection. The Müller muscle was already detached from the tarsus in the superior tarsal edge.

**Fig. 2.** Correcting upper eyelid retraction, continued. (*Above*) Checking to see that the eyelid has been positioned lower than the desired location at a sitting position. (*Below*) Fixating the detached muscle to the tarsal plate after inducing ptosis.

## RESULTS

The normal upper eyelid position was established to cover 1 to 2 mm of the upper cornea. Sixty-one cases (86 percent) demonstrated satisfactory results, where the eyelid height was within 0.5 mm of the normal position. Six cases (8 percent) developed mild ptosis, where the eyelid was within 1 mm below the normal position. Four cases (6 percent) underwent further revision operations for retraction greater than 1 mm above the normal position. All of the unsatisfactory cases were corrected through revision surgery (Table 2); however, revision was not performed on patients satisfied with their results. There were also few cases in which asymmetry in the double eyelid folds occurred. These cases were corrected with minor revisions. No other complications, such as infection or hematoma, occurred.

## CASE REPORTS

### Case 1

A 31-year-old female patient had undergone ptosis correction before surgery and subsequently developed eyelid retraction on the left eye (Fig. 5). In her consultation, she expressed distress with her eyelid asymmetry and right ectropion. Her left retraction was corrected with the pretarsal tissue lengthening technique and lowered 2 × 4 mm. After 6 months, her eyelids showed normal height with symmetry.

### Case 2

A 33-year-old female patient underwent ptosis correction 3 years before our operation and developed eyelid retraction in her left eye (Fig. 6). Before our operation, she had undergone two corrective procedures for retraction without significant improvement. The pretarsal lengthening technique was applied to lower her left eyelid by 3 mm and lengthen the pretarsal tissue by 6 mm by means of two rotation flaps. After 28 months, her eyelids finally attained normal height.

### Case 3

A 54-year-old man had undergone mild ptosis correction and double-eyelid surgery 8 months before our surgery and subsequently developed left medial side retraction and right ptosis (Fig. 7). In his consultation, he expressed distress with his eyelid asymmetry and left ectropion and lagophthalmos. His left retraction was corrected with the pretarsal tissue lengthening technique and lowered 1.5 × 4 mm. Right ptosis was corrected 6-mm levator shortening. After 6 months, his eyelids show normal height with symmetry.

## DISCUSSION

The vertical length of East Asian eyes is typically shorter than that of Caucasian eyes. Korean eyes specifically have an average vertical length of 8 to 8.5 mm, and it is found to be less than 8 mm in only 30 percent.[1] Many East Asian patients desire larger eyes, and vertical eye enlargement is known to create more aesthetically pleasing eyes.

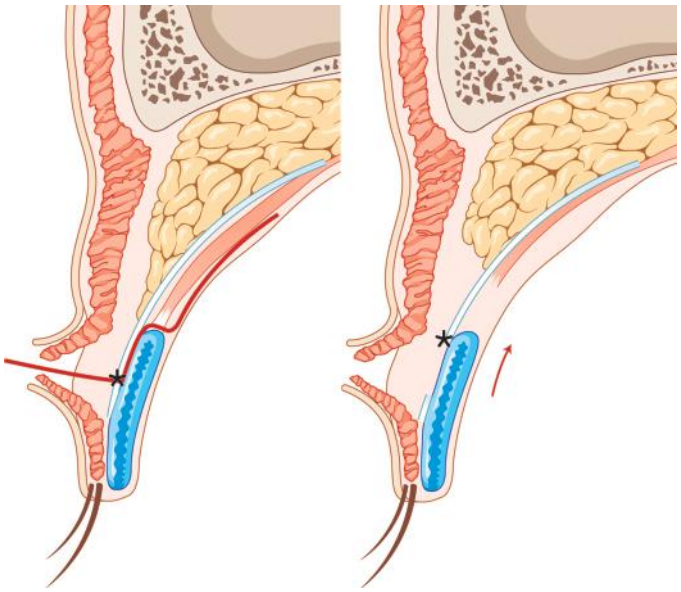

**Fig. 3.** Illustrations demonstrating pretarsal tissue lengthening. The plane of dissection showing separation of pretarsal tissue from the tarsal plate and detaching the Müller muscle from the conjunctiva (*left*), and pretarsal tissue secured to the upper border of the tarsus after lengthening (*right*).

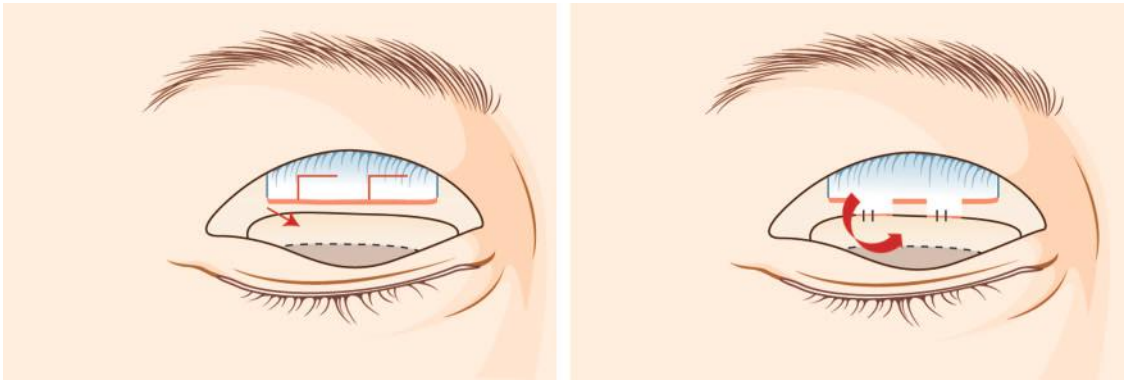

**Fig. 4.** If more lengthening is needed after pretarsal separation, a superiorly based rotation flap can be created.

Therefore, it has become a popular procedure.[2,3] The procedure is achieved mainly with double-eyelid surgery and/or ptosis correction. Despite its popularity and versatility, the procedure presents various complications. It is often difficult to assess the functionality of the upper eyelid levator muscle under local anesthesia, which may cause undercorrection or retraction if ptosis is overcorrected. In retraction, the upper sclera is generally exposed, often giving the patient an unnatural and intimidating appearance. In unilateral retraction, there is distinct asymmetry of the eyes on both downward and neutral gaze. Therefore, correction is often needed for cosmetic purposes. Moreover, the person may suffer lagophthalmos, dry eye syndrome, and exposure keratopathy syndrome caused by changes in the palpebral fissure. Therefore, correction may be needed for functional purposes as well.

Eyelid retraction correction techniques have included Müllerectomy, levator recession (with or without Müllerectomy), levator lengthening, and spacer grafting.[4–10] In cases of severe retraction, spacer grafting is necessary because of significant lengthening. There are many substances that can be used as external spacer grafts, including collagen film, cadaveric dermis, fascia lata, deep temporal fascia, gold, and banked sclera.[11–17] However, de-

**Table 2. Result of Pretarsal Tissue Lengthening Procedure**

| Result of Operation | No. of Cases (%) |
|---|---|
| Satisfaction (results with ±0.5 mm of the normal position) | 61 (86) |
| Overcorrection (induced ptosis) | 6 (8) |
| Undercorrection (recurred retraction) | 4 (6) |
| Total | 71 (100) |

pending on the substance materials, spacer grafting methods could cause contraction, displacement of the graft, infection, and/or donor-site morbidity.[18]

There are two main types of eyelid retraction. Eyelid retraction caused by hyperthyroidism (Graves' disease) differs structurally from that caused by ptosis overcorrection. In hyperthyroidism-induced retraction, releasing the levator muscle alone is insufficient for correcting the severe retraction. In such cases, spacer grafts are used to significantly lengthen the distance between tarsus and levator. The eyelid does not retract so severely in the retraction after ptosis operation, as it is rare for surgeons to overcorrect ptosis by more than 3 mm. Thus, most cases of retraction are corrected by lowering the eyelid at most 3 mm. Correcting the retraction also requires acute precision, as it has both functional and cosmetic purposes; even the slightest asymmetry could produce unsuccessful results.

A conventional issue with retraction after ptosis surgery is tissue fibrosis (scar tissue). In prior techniques, this scar tissue was often released or excised when the levator was separated from the tarsus and external spacer grafts were used to lengthen the levator to achieve good results. However, there have been various ideas on the size of spacer grafts. The size of the spacer in relation to the amount of retraction varied from the same to two times the size. Our technique takes the scar tissue by using the levator–Müller muscle complex as a local spacer flap. The pretarsal levator–Müller muscle complex is a combination of the levator aponeurosis, Müller muscle, pretarsal tissue, and scar tissue. By releasing this complex in a cephalad direction, the pretarsal tissue is conveniently lengthened for reattachment to the tarsus at the appropriate level. This step reinduces a temporary ptotic state, such that the complex can be refixed properly at a desired eyelid height. The complex is lightly reattached once an appropriate position on the tarsus is determined. The patient is then asked to open their eyes to test the position for symmetry and balance, such that the eyelid is at its ideal height, neither ptotic nor retracted. If the eyelids are not symmetric and/or demonstrate the

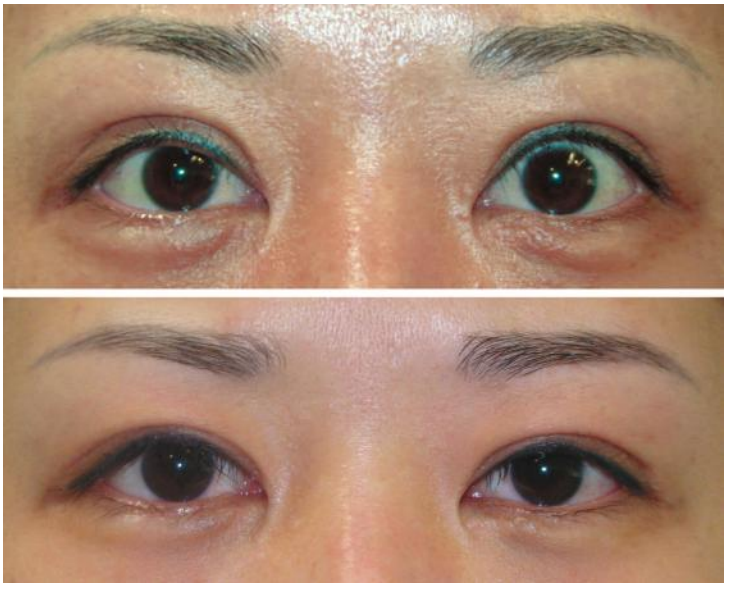

**Fig. 5.** Case 1. A 31-year-old female patient had undergone ptosis correction before surgery and subsequently developed eyelid retraction on the left eye. In her consultation, she expressed distress with her eyelid asymmetry and right ectropion (*above*). Her left retraction was corrected with the pretarsal tissue lengthening technique and lowered 2 × 4 mm. After 6 months, her eyelids show normal height with symmetry (*below*).

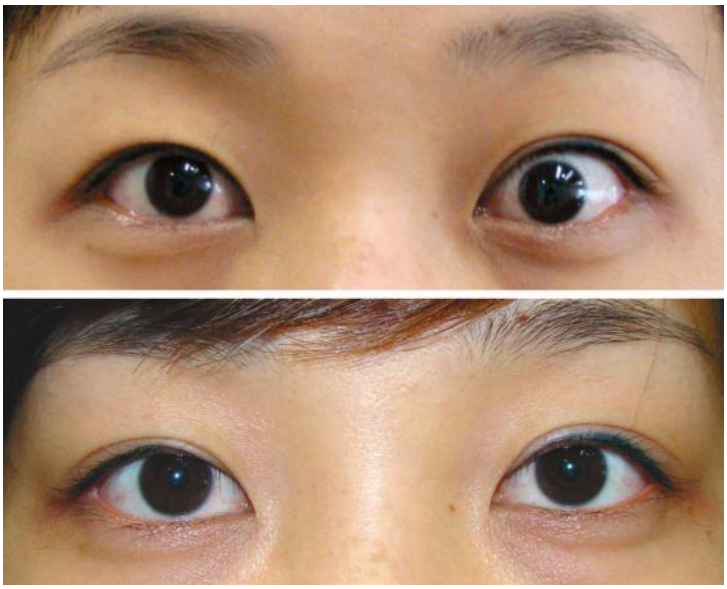

**Fig. 6.** Case 2. A 33-year-old female patient underwent ptosis correction 3 years earlier but developed eyelid retraction on the left eye. She had undergone correction for retraction at another practice, twice without significant improvement. She had also developed lagophthalmos (*above*). The eyelid retraction was corrected by lengthening the pretarsal tissue. Her left eyelid was lowered 3 mm with the pretarsal tissue rotation flap. Twenty-eight months after the operation, her eyelids attained normal height.

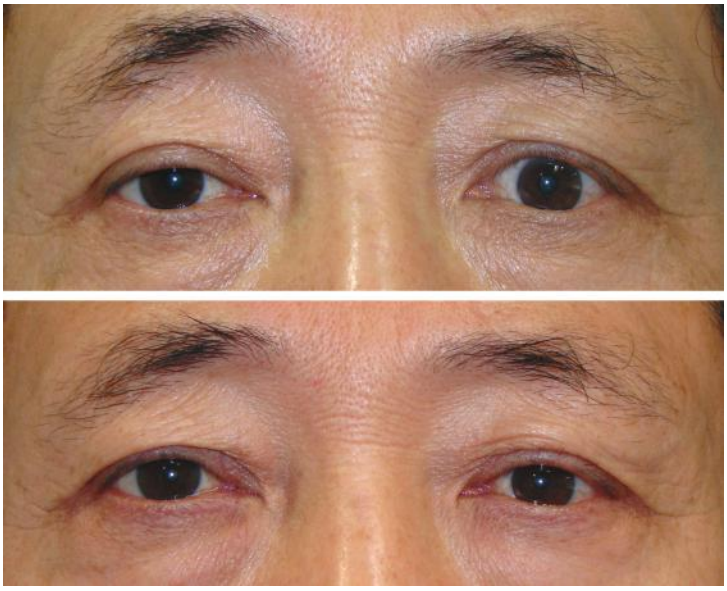

**Fig. 7.** Case 3. A 54-year-old man had undergone mild ptosis correction and double-eyelid surgery 8 months before our surgery and subsequently developed left medial side retraction and right ptosis. In his consultation, he expressed distress with his eyelid asymmetry and left ectropion and lagophthalmos (*above*). His left retraction was corrected with the pretarsal tissue lengthening technique and lowered 1.5 × 4 mm. Right ptosis was corrected with 6-mm levator shortening. After 6 months, his eyelids show normal height with symmetry (*below*).

slightest degree of ptosis or retraction, the complex is unfixed from the tarsus and repositioned. In some cases, a rotation flap is created for additional length, as will be detailed. This process of determining the ideal position repeats until the eyes appear symmetrical and balanced. The final process is to secure the complex at the established position. This operation changes the retraction state to the ptotic state, and then the ptosis operation is performed, expecting the postoperative descent caused by tissue loosening/cheese-wiring effect and performing overcorrection correlated to undercorrection in the retraction.

The main benefit of this levator–Müller muscle complex is that it is an inherent substance that acts as a spacer graft. It does not require two separate places for fixation at the superior and inferior planes, as is required by external grafts. Rather, it has a single plane for fixation at its inferior base, because its superior base naturally connects to the levator aponeurosis. In addition, external spacer grafts must be shaped and cut before they are placed between the levator aponeurosis and tarsus and then secured at two planes of fixation. If repositioning is needed, the graft is released, reshaped, and then secured again. However, when adjustment was needed in our technique, more recess or more advancement was easily achieved. Also, the change in eye size after fixation suture has a minimal effect on cheese-wiring in a single plane rather than in two planes.

Of the 71 cases, 61 had satisfactory results produced by lengthening the levator–Müller muscle complex alone. Four cases redeveloped retraction after surgery. This resulted from insufficient distance between tarsus and levator aponeurosis. Six patients developed mild ptosis. There were a total of 10 cases that needed revision surgery, which was performed 2 to 3 weeks after the previous correction, when the swelling had subsided and eyelid position had relatively settled down.

In terms of technical specifications, an eyelid retraction of 1 mm is corrected by lengthening the complex by 1 to 2 mm, and fixing it 1 mm higher than the desired position to account for postoperative descent. In these mild retractions, the pretarsal lengthening technique is sufficient for lowering the retracted eyelid to the normal position. However, in cases where the levator–Müller muscle complex does not offer sufficient length, a superiorly based rotation flap is created on the pretarsal tissue. This rotation flap further lengthens the distance between the tarsus and the levator aponeurosis.

Of the 10 cases that needed revision, there were six that resulted in mild ptosis after the first retraction correction. Initially, multiple rotation flaps were designed, narrow in width. These flaps were to be secured to the tarsus; however, because they were designed too narrow, dehiscence occurred in the pretarsal tissue. As a result, mild ptosis was observed in six of the 71 cases but was corrected during revision surgery. The rotation flap method was revised carefully such that only one or two flaps should be made, larger in width. The rest of the cases in need of another correction procedure—the four that had recurrent retraction—underwent the revised rotation flap technique for further lengthening, which successfully corrected any prior retraction.

The pretarsal lengthening technique has some advantages. One of the major advantages is simplicity, as this technique does not require any remote spacer grafts. Another advantage is the ability to constantly monitor the change in eyelid height while the procedure is performed. One technical caveat among its advantages is local anesthesia. To minimize eye size change, an equal and minimal amount of local anesthesia was used on each eyelid to prevent the local effect of lidocaine and epinephrine or excessive swelling. The original eye size was examined before separating the levator–Müller muscle complex from the superior tarsal edge and conjunctiva. It was important to examine whether the reduction in eye size/eyelid height was caused by the actual detachment of the levator–Müller muscle complex or by other factors such as anesthetic infiltration, hematoma, or tissue swelling. Any notable difference was taken into account in determining the final position of the eyelid.

## CONCLUSIONS

It is a difficult task to correct upper eyelid retraction caused by ptosis overcorrection, because of tissue fibrosis and the required level of precision. Many techniques have been used to correct retraction. By performing correction with lengthening the native levator using pretarsal tissue, there is no need for external spacer grafts, and precise fixation of the released levator–Müller muscle complex at the proper height can be achieved. Therefore, upper eyelid retraction can be more easily corrected, with a relatively low chance for recurrence.

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