Review Article

# Evaluation and Management of Unilateral Ptosis and Avoiding Contralateral Ptosis

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## Abstract

Treating unilateral ptosis can be challenging and a proper preoperative evaluation may help prevent unexpected outcomes on the contralateral lid. Preoperative evaluation should include testing for Hering's law, which remains useful in understanding the phenomenon of induced contralateral eyelid retraction in the context of ptosis. Approximately 10% to 20% of patients with unilateral ptosis have some degree of induced retraction on clinical evaluation in the contralateral lid. When there is a positive Hering's test on preoperative examination, the surgeon should consider a bilateral ptosis procedure. The surgical approach to unilateral ptosis depends on the severity of the ptosis and its etiology, and the surgeon should be aware of which procedure is most likely to provide the best outcome in selected instances.

## Keywords

ptosis, ptosis surgery, unilateral ptosis, Hering's law, contralateral eyelid retraction

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Obtaining optimal height and symmetry can be difficult in ptosis surgery and the management of unilateral upper eyelid ptosis can be very challenging. The etiology of unilateral ptosis is essentially similar to bilateral cases; however, the surgical attention is focused on one lid rather than both. As a result, there is inherently an increased risk of postoperative asymmetry between the two lids. A proper preoperative evaluation can potentially decrease such outcomes.[1,2]

Patients with ptosis present with an abnormally low position of the upper eyelid, which may be congenital or acquired. In acquired cases, patients often complain of a tired appearance and, when the condition is significant enough, deficits in their superior visual field. To compensate for this, patients may elevate their chin position or contract their frontalis muscle to raise their brow position (Figure 1). The eyelid position is mainly controlled by the effects of the levator muscle complex, which is innervated by the oculomotor nerve. The Mueller muscle plays a small role by providing sympathetic innervation to the lid position.

## EVALUATION FOR PTOSIS

Proper evaluation for ptosis is essential in identifying any asymmetry and can help elucidate the etiology of the ptosis. Proper evaluation involves taking accurate measurements of the eyelids, which includes the margin to reflex distance (MRD), levator function, palpebral fissure, and the superior lid crease. MRD is the distance from the margin of the upper lid to the central corneal reflex (normal is 4.0-4.5 mm; Figure 2). In general, eyelid asymmetry is confirmed when the relative difference in MRD between both eyelids is 1 mm or greater. Levator function measures the distance of excursion of the upper eyelid margin from far downgaze to upgaze while the frontalis muscle is held still with the examiner's hand (normal is 14 mm or more) (Figure 3). The palpebral fissure is the distance between the upper and lower lid margin while the patient is in primary gaze (normal range can vary from 7-12 mm). The superior lid crease is the vertical distance of the superior lid margin from the natural lid crease in downgaze (normal 8-10 mm).

There are various causes of ptosis, including congenital, aponeurotic, neurogenic, myogenic, and mechanical. Congenital ptosis is the failure of neuronal migration

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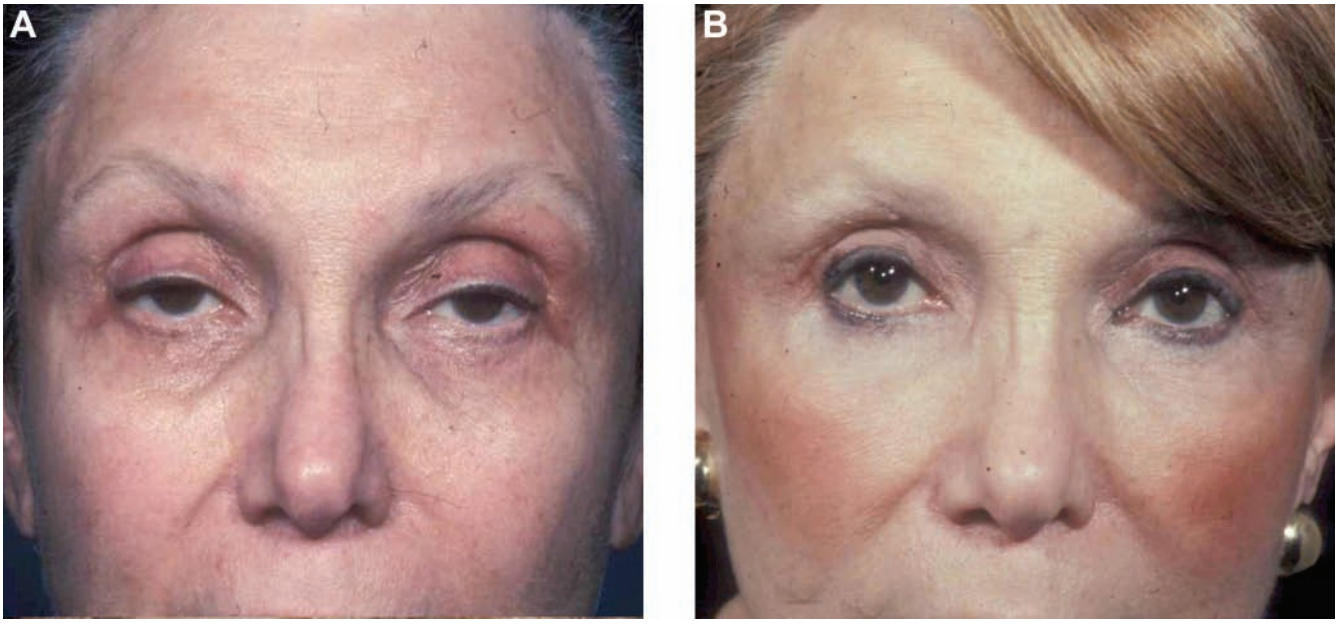


**Figure 1.** (A) This 67-year-old woman demonstrates preoperative appearance of bilateral ptosis with compensatory brow elevation bilaterally. (B) Improvement is evident in the lid position and the drop in brow position six months after undergoing bilateral Fasanella-Servat procedure on the upper lids.

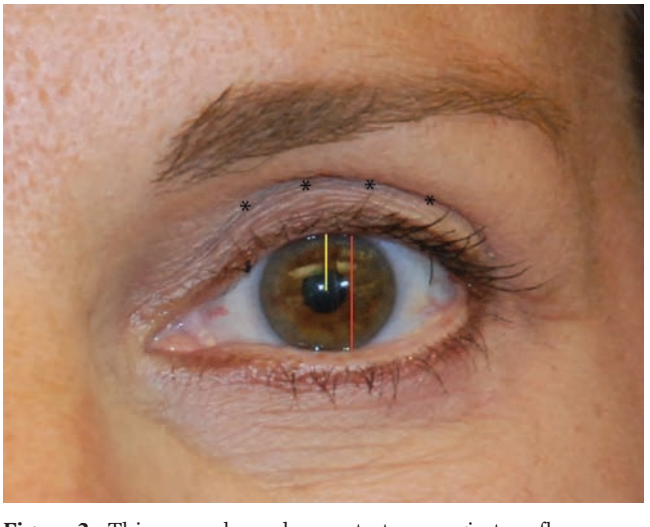

**Figure 2.** This normal eye demonstrates margin to reflex distance (MRD) (yellow line) and palpebral fissure (red line). MRD is the distance from the margin of the upper lid to the central corneal reflex (normal is 4.0-4.5 mm). The palpebral fissure is the distance between the upper and lower lid margin while the patient is in primary gaze (normal range can vary from 7-12 mm). Asterisks demonstrate the superior lid crease.

within the levator muscle complex. As a result of that failure, fibrous and adipose tissues are present in the muscle belly (rather than normal muscle fibers), diminishing the ability of the levator to contract and relax. It can be unilateral or bilateral, with variable severity. Mild cases show some reasonable levator function, whereas severe cases present with very poor levator function and absent lid crease. Given the levator muscle's inherent inability to relax, the ptosis improves on downgaze. Prior to surgical evaluation, these patients need to be evaluated for amblyopia by an ophthalmologist.

Aponeurotic ptosis is also referred to as involutional ptosis. This is the most common type of ptosis and is usually seen in elderly patients. It is the result of a disinsertion or dehiscence of the levator aponeurosis from its distal insertion in the eyelid. It most commonly occurs in the elderly as an involutional disorder or presents after ocular surgery, often being termed *postcataract ptosis*. Although less common in younger patients, aponeurotic ptosis is associated with contact lens use, ocular trauma, ocular surgery, and periocular infection. Rigid contact lens wear has a stronger association with acquired ptosis than soft contact lens wear.[3] Aponeurotic ptosis can present bilaterally or unilaterally. Patients typically have normal levator function. However, the superior lid crease is usually elevated due to the levator's disinsertion or dehiscence.

Neurogenic ptosis is an innervational defect due to an oculomotor nerve palsy. Patients will have a complete ptosis with no levator function. The ipsilateral eye will also present with an exotropia (outwardly deviated strabismus) with subsequent deficits in adduction, elevation, and depression. Patients with a neurogenic ptosis need to be evaluated by an ophthalmologist for etiology, which can include central nervous system (CNS) aneurysms, diabetes, hypertension, or trauma.

Myogenic ptosis is seen in defects within the neuromuscular junction or levator muscle complex; it can be due to myasthenia gravis or muscular dystrophy.

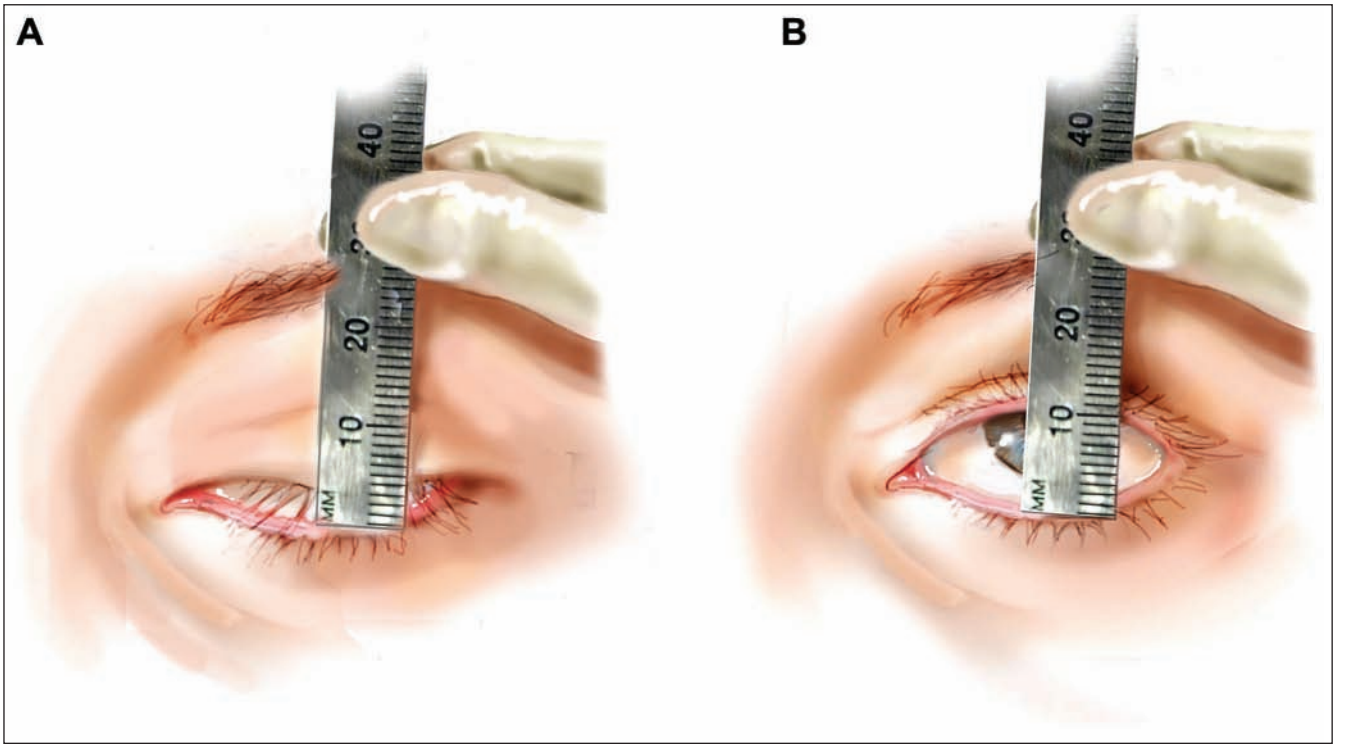


**Figure 3.** (A) Levator function is measured while the patient looks down. (B) While holding the frontalis muscle in place with his or her hand, the surgeon measures the excursion of the eyelid in far upgaze.

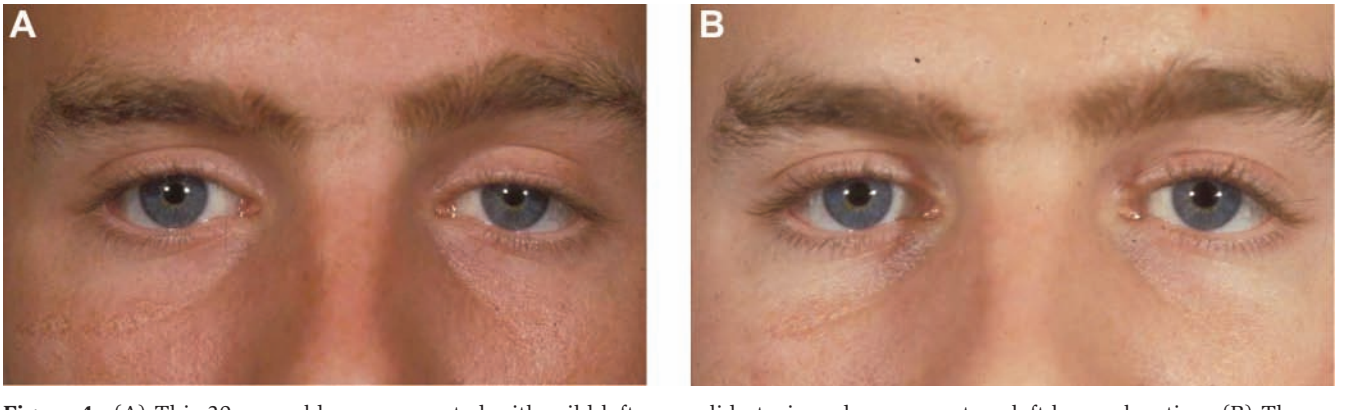


**Figure 4.** (A) This 20-year-old man presented with mild left upper lid ptosis and compensatory left brow elevation. (B) The patient's brow position demonstrates improvement five months after undergoing successful left upper lid Fasanella-Servat procedure.

Mechanical ptosis results from gravity mass effects or contraction from a scar.

## HERING'S LAW AND UNILATERAL PTOSIS

Hering's law of motor correspondence has been applied to contralateral lid position changes after unilateral ptosis surgery.[2,4] The levator muscles are yoke muscles, which enables them to work in synchrony with each other. As a result, afferent input from one eyelid can affect the position of both eyelids. In cases of eyelid ptosis causing superior visual field defects, afferent input increases the innervation to both eyelids in an attempt to reduce the ptosis. Patients often compensate with an elevation of their brow position, in an effort to recruit frontalis muscle function to aid in raising the final eyelid position (Figure 4).[5] Similarly, in unilateral ptosis of the upper lid, the contralateral upper eyelid can present with pseudoretraction (Figure 5). In such cases, the ptotic lid may actually appear normal in position, whereas the contralateral lid rests higher due to Hering's law.

**Figure 5.** This 17-year-old woman demonstrates pseudoretraction present in the right upper lid secondary to left upper lid ptosis. The right upper lid returned to normal position after successful ptosis repair of the left upper lid.

In patients with inadequate preoperative evaluation, the unoperated contralateral lid may end up more ptotic after unilateral ptosis repair. The eyelid that was preoperatively ptotic maintains a normal lid position and there is a decreased afferent input from that eyelid, which results in brow elevation. As a result, the contralateral lid maintains a lower position, with subsequent asymmetry between the two lids (Figure 6). To achieve optimal outcomes in treating unilateral ptosis, the surgeon should conduct a thorough preoperative evaluation, which includes the unmasking of pseudoretraction.

## UNMASKING PSEUDORETRACTION

Prior studies have suggested that approximately 10% to 20% of patients with unilateral ptosis have some degree of induced retraction on clinical evaluation in the contralateral "normal" eyelid.[1,2,6] In most cases, the effect is subtle and the contralateral eyelid actually appears "normal." Although less common, the induced elevation can sometimes be sufficient to produce lid retraction above the superior limbus of the eye.

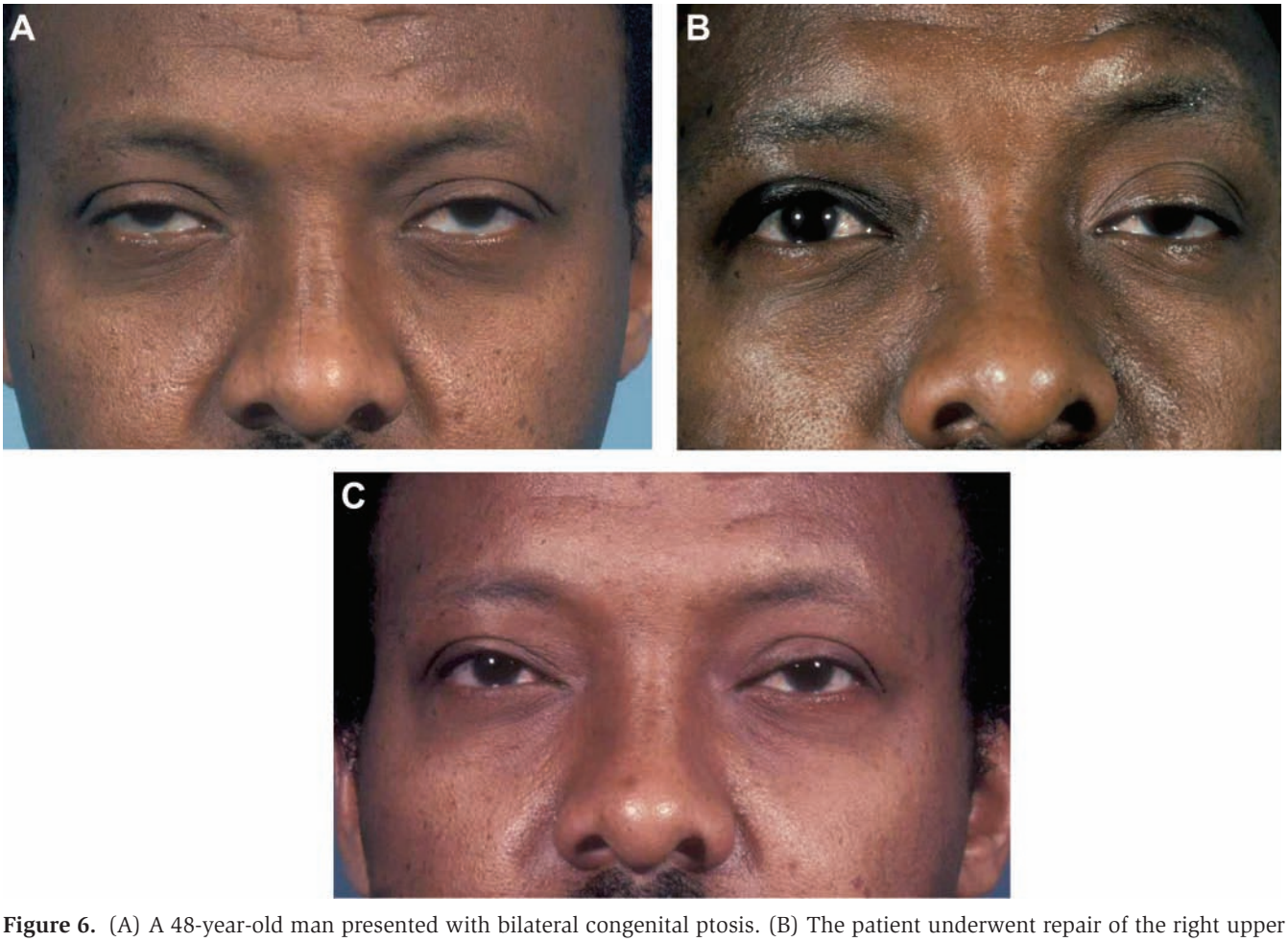


**Figure 6.** (A) A 48-year-old man presented with bilateral congenital ptosis. (B) The patient underwent repair of the right upper lid first; note the subsequent drop in the left upper lid's position and compensatory brow elevation due to Hering's law one month postoperatively. (C) Improved lid and brow position is demonstrated five months after bilateral ptosis surgery.

Several tests can be performed to unmask the pseudoretraction and identify whether the patient presents with bilateral ptosis rather than unilateral ptosis. These tests can anticipate this possibility and may prevent an undesirable postoperative result. Occlusion of the ptotic eye, manual elevation of the ptotic eye, and the phenylephrine test are different methods that can be employed to identify pseudoretraction in the contralateral lid. All have been reported to be effective in unmasking contralateral ptosis[4,7-9]; nevertheless, one study compared all three methods and suggested a higher rate of success using the manual elevation test. The phenylephrine test may be more sensitive in mild cases of ptosis, though, and is a worthwhile adjunct method to manual elevation in such cases.[2]

In general, the eyelid position (MRD) is measured after performing one of these described tests. A decrease in 1 mm or more in the contralateral lid position is considered a positive test. In such instances, the patient should be counseled for the increased likelihood of postoperative ptosis in the contralateral eye and the surgeon should consider bilateral ptosis surgery. Nevertheless, both anecdotal experience and a recent study have shown that, despite a negative Hering's test, there are those who can still develop a postoperative decrease in their MRD and resulting ptosis.[4,7-9] Unfortunately, the identifiers that may predispose patients to this scenario are uncertain and patients with unilateral ptosis with a negative Hering's test should also be counseled on the possibility of postoperative contralateral ptosis.

### Occlusion of the Eye

Brief occlusion of the ptotic lid is performed by either taping the eyelid shut or patching for at least 15 seconds. This technique has been found to be the least sensitive among the tests described.[2] Although cumbersome and not practical in the clinical setting, prolonged patching of the eye can be more sensitive in detecting this phenomenon.

### Manual Elevation of the Ptotic Eye

Manual elevation of the ptotic lid (with either the examiner's finger or a cotton-tip applicator) is still the most sensitive test for identifying contralateral ptosis. If the ptotic lid is manually elevated to the superior limbus by the examiner, this permits the patient to continue fixation with the eye but removes the need for excessive innervation to both eyelids in an attempt to reduce the ptosis. As a result, the contralateral lid returns to its normal position after several seconds. Once the manually elevated lid is then released, the afferent input is once again increased to both eyelids and results in an increase in the lid position of the contralateral eye.

### Phenylephrine Test

An ophthalmic solution of 2.5% phenylephrine hydrochloride is instilled in the ptotic eye. Eyelid positions are evaluated 10 minutes after instillation of the drop. Phenylephrine pharmacologically elevates the eyelid by stimulating Mueller's muscle, which is a sympathetically innervated elevator muscle of the upper lid. Although not as sensitive as the manual elevation test, the phenylephrine test is still widely applied and may be more sensitive in mild cases of ptosis due to the sustained lift it provides.

## OCULAR DOMINANCE AND ITS RELATIONSHIP TO PTOSIS

Although it is not imperative to assess for ocular dominance (ie, which eye a patient favors when viewing an object), studies have shown that nondominant eyes have a higher rate of ptosis. Furthermore, ptosis of the dominant eye is more likely to be associated with induced elevation of the contralateral lid.[2] Ocular dominance can be determined with various techniques. We prefer a variation of Scobee's test.[10] Briefly, this test is administered to determine which eye a patient favors during binocular fixation on a target. While the patient is asked to focus on a fixation target 20 feet (6 meters) away, he or she is also asked to raise a cardboard with a 1-cm hole in its center with both hands. The patient is then instructed to find the target with one eye shut. This is repeated twice for confirmation. Most patients will consistently prefer the same eye on all attempts.

## MANAGEMENT

The surgical approach to unilateral ptosis depends on its severity and etiology. Patients with severe ptosis with poor levator function will need to be treated with a frontalis-sling procedure. Levator resection through an anterior (transcutaneous) approach is indicated in cases with fair to good levator function (at least 5 mm of levator function). Patients with reasonably good or excellent levator function can be treated with either a posterior approach or an anterior aponeurosis repair.[11]

Congenital ptosis usually needs to be addressed early if amblyopia is a concern, especially in unilateral cases. Depending on the levator function, different procedures can effectively correct the ptosis. Poor levator function ($<4$ mm) will require a frontalis-sling procedure,[12] whereas fair levator function ($>4$ mm) may be corrected with a levator resection.[13]

For aponeurotic ptosis, several options are available, depending on the severity of the ptosis. For instance, a posterior approach (eg, Fasanella-Servat procedure or Müller-conjunctival resection) can correct mild cases.

Alternatively, an anterior approach with reinsertion or advancement of the levator muscle complex can be performed.[14] Various modifications of the traditional anterior approach have been described recently, such as a small incision anterior approach[15] and a three-step anterior approach technique that can be performed under general anesthesia with good accuracy.[16]

Despite these guidelines, it is usually the surgeon's preference as to which procedure is best. We recommend performing the Fasanella-Servat procedure in mild-to-moderate cases of ptosis. We have found it to be an extremely predictable operation that does not require patient cooperation and can be performed under general anesthesia in combination with other aesthetic procedures. Furthermore, it is free of major complications and allows for the unique ability to adjust the eyelid position and contour postoperatively.[17] Other advantages include efficient surgery with minimal tissue dissection and relatively quick postoperative recovery time.

## THE FASANELLA-SERVAT PROCEDURE

Local anesthesia of 2% lidocaine with 1/100,000 units of epinephrine is administered to subcutaneously infiltrate the upper lid skin. Patients can receive monitored intravenous sedation or general anesthesia. Once protective corneal shields are placed, a typical blepharoplasty incision is made along the upper eyelid crease with a #15 blade. A conservative resection of skin and preseptal orbicularis oculi muscle can be performed in cases of dermatochalasis, followed by opening of the orbital septum and contouring of medial and central orbital fat. The upper eyelid is then everted (Figure 7) and two symmetrically-shaped, curved hemostat clamps are placed tip to tip for a tarsoconjunctival resection of 2, 4, or 6 mm, corresponding to the amount of lift required (1, 2, or 3 mm, respectively; Figure 8). Care is taken such that the central portion of the eyelid corresponds to the largest amount of tarsal resection. A 5-0 nylon suture is

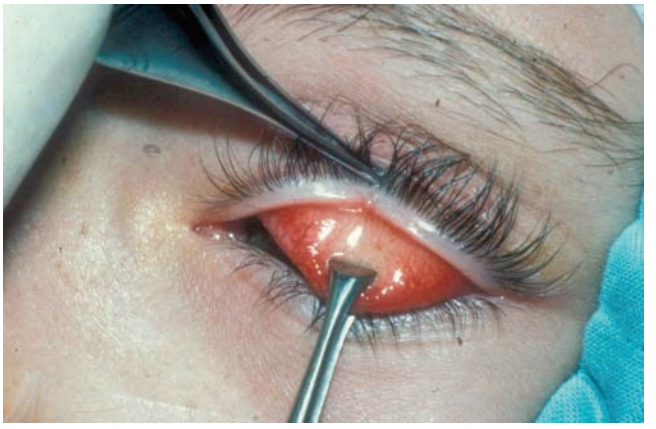

**Figure 7.** The upper lid is everted to evaluate the tarsus.

passed through the central aspect of the eyelid wound and angled laterally to exit just beneath the clamps along the posterior aspect of the eyelid (Figure 9). The suture is then passed beneath the hemostats in a running, buried fashion from lateral to medial. Each exit from one pass is treated as the entry point for the following pass, thereby burying all loops of the suture (Figure 10). After the suture has been run below the whole length of the two clamps, a #15 blade is employed for a tarsoconjunctival resection of the tissue distal to the clamps (Figure 11). The hemostats act as guides for the #15 blade, to safely remove the desired amount of tissue while protecting the running suture. The 5-0 nylon is next passed from the posterior and medial aspect of the tarsus and angled to exit just adjacent to the opposite arm of the suture in the eyelid wound. The suture is tied with multiple knots and left long for externalization and easy retrieval. The eyelid wound is closed with a running 5-0 nylon subcuticular suture, with interrupted 6-0 nylon sutures laterally. The eyelid is dressed with mastisol and Steri-strips (3M Healthcare, St. Paul, Minnesota).

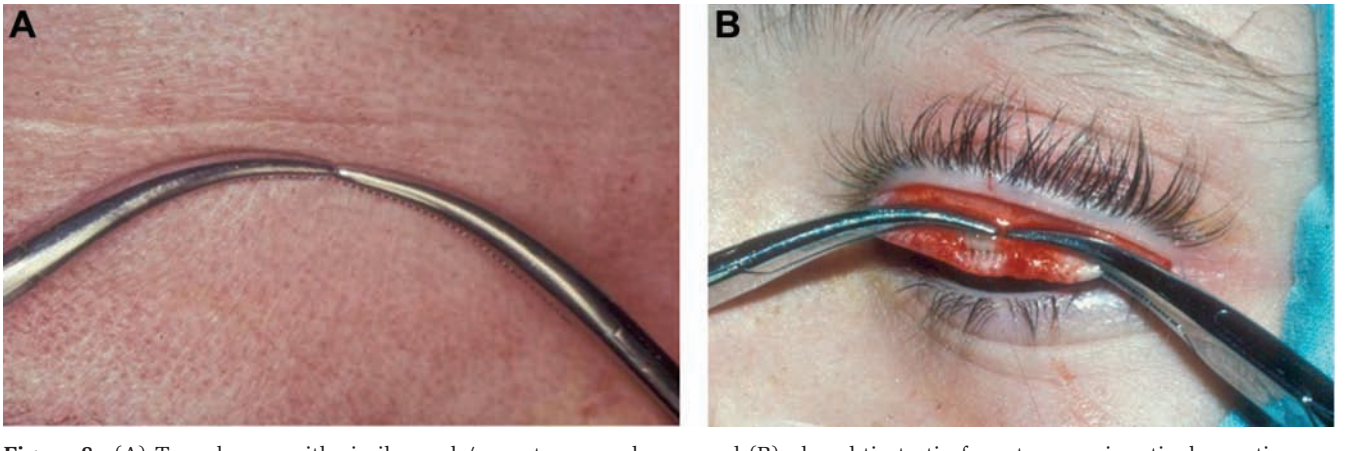


**Figure 8.** (A) Two clamps with similar arch/curvature are chosen and (B) placed tip-to-tip for a tarsoconjunctival resection.

**Figure 9.** A 5-0 nylon suture is passed through the central aspect of the eyelid wound and angled laterally to exit just beneath the clamps.

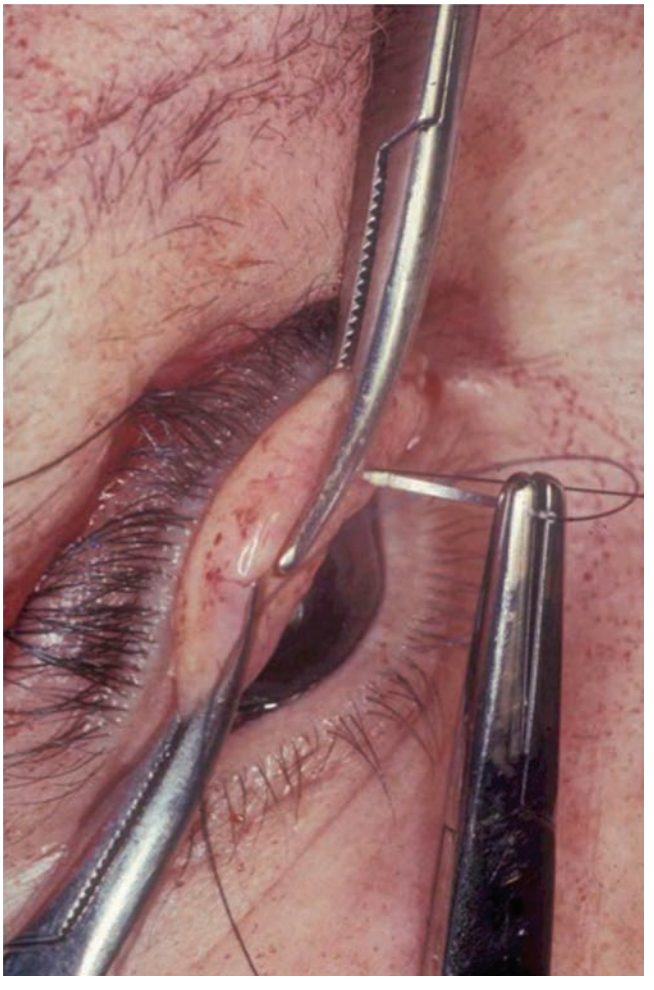

**Figure 10.** Each exit from one pass acts as the entry point for the following pass, thereby burying all loops of the suture.

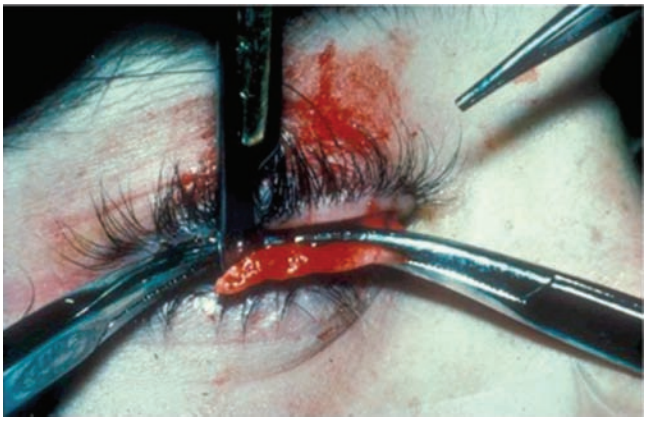

**Figure 11.** The hemostats act as guides for the tarsoconjunctival resection by sliding a #15 blade above the clamps to remove the desired amount of tissue.

Patients are prescribed TobraDex eyedrops (Alcon, Fort Worth, Texas) and lubricating ointment for the first postoperative week. Sutures are usually removed on postoperative days five to seven.

## ADVANTAGE OF THE FASANELLA-SERVAT PROCEDURE: POSTOPERATIVE ADJUSTMENT

This adjustment can be a simple and effective component of postoperative suture removal, allowing the Fasanella-Servat procedure to become an adjustable ptosis repair. Six days postoperatively, much of the edema resolves, but tissues have not yet densely fibrosed. At this time, small manipulations of soft tissue can be easily achieved. Minor asymmetries, eyelid peaking, and the potential height differential due to Hering's law can all be treated (Figures 12

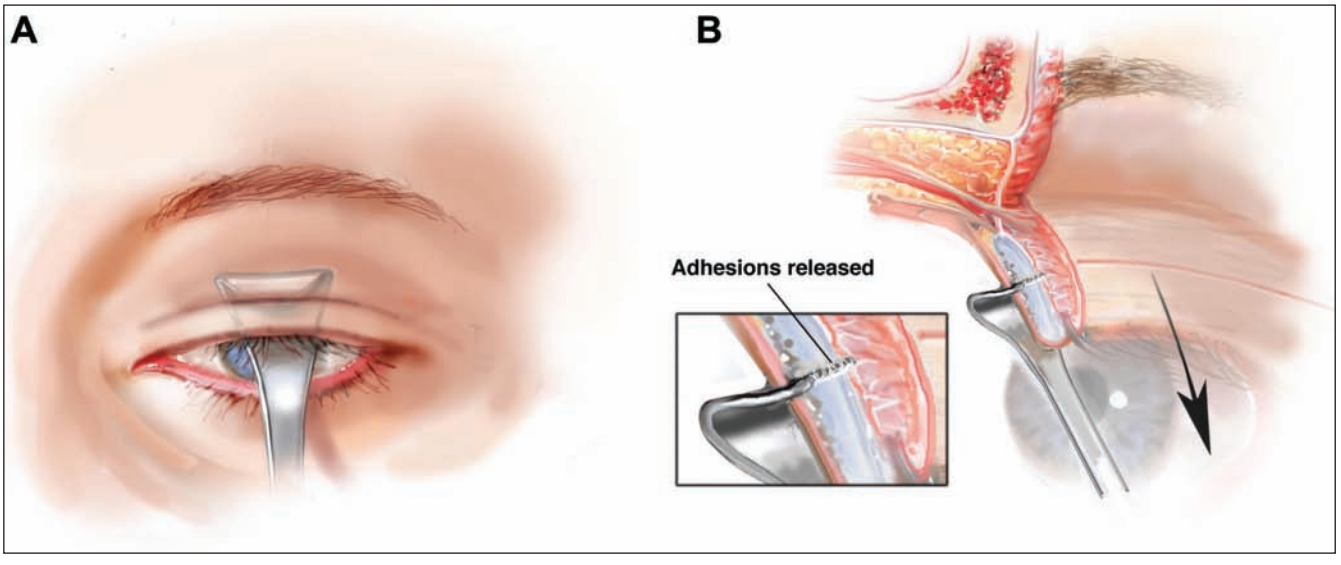


**Figure 12.** (A) A Desmarres retractor can gently dehisce the tarsal adhesions (B) in order to adjust the lid contour or height within the first week after performing a Fasanella-Servat procedure.

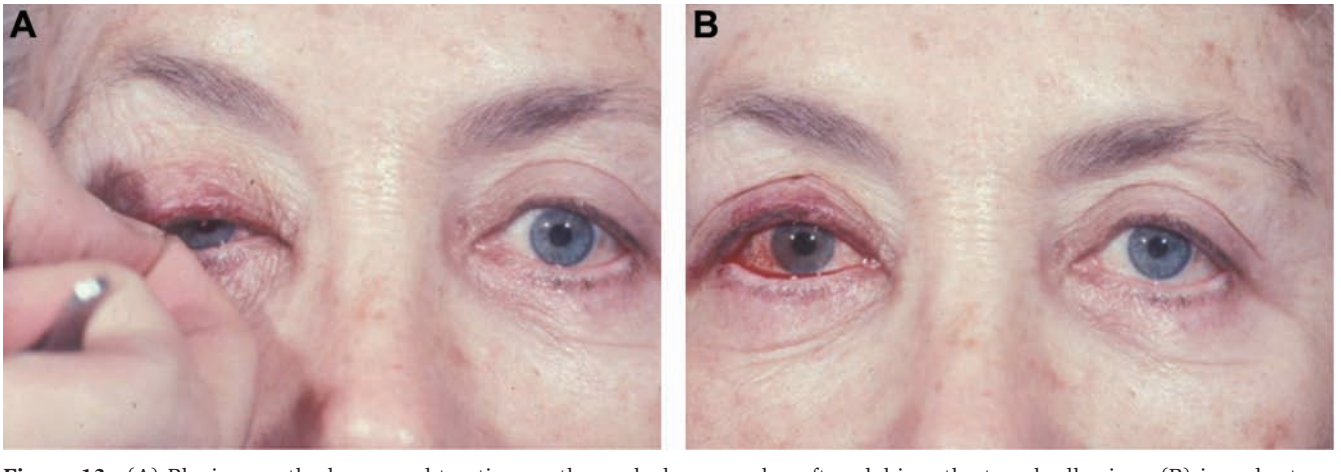


**Figure 13.** (A) Placing gentle downward traction on the eyelashes can also often dehisce the tarsal adhesions (B) in order to adjust the lid contour or height within the first week after performing a Fasanella-Servat procedure.

and 13). These adjustments involve minimal to no pain for the patient and do not require anesthesia or sedation. Although some adjustments treat frank overcorrections, most involve minimal sectoral manipulations of the upper eyelid to smooth contour and improve symmetry. We performed a retrospective study to further evaluate the early postoperative adjustment Fasanella-Servat procedures can provide. In our study, 102 eyelids (54 patients) underwent the Fasanella-Servat procedure during a one-year period. Postoperative adjustments at the time of suture removal were performed in 22 eyelids (22%) in 19 patients to improve mild eyelid asymmetries.[17] Overall, all patients tolerated the postoperative adjustments well and were very pleased with the final outcome of their lid positions.

## COMPLICATIONS OF FASANELLA-SERVAT

Most of the complications—such as overcorrections, poor eyelid margin contour, and peaking—can be managed in some form through the postoperative adjustment technique as mentioned above.

Although uncommon, an exposed suture can cause corneal irritation and possible abrasion or infection (keratitis). Patients will often complain of increased tearing, redness to the eye, and a sharp pain. Treatment involves an ophthalmic slit-lamp examination and management based on the diagnosis. A corneal abrasion should be treated aggressively with ophthalmic ointment and a therapeutic soft contact lens until the suture is removed. If these measures fail, the eyelid should be everted and the suture removed.

## CONCLUSIONS

In summary, a proper preoperative evaluation of ptosis will guide appropriate surgical management in unilateral cases. Hering's law remains useful for understanding the phenomenon of induced contralateral eyelid retraction in the context of ptosis. Approximately 10% to 20% of patients with unilateral ptosis have some degree of induced retraction on clinical evaluation in the contralateral lid. As a result, the surgeon must be prepared to evaluate for contralateral ptosis by performing a manual elevation test or phenylephrine test. The surgeon and patient should be aware that although a proper preoperative evaluation will help reduce the incidence of postoperative contralateral ptosis, the possibility is still present despite a negative Hering's test. When there is a positive Hering's test on preoperative examination, the surgeon should consider a bilateral ptosis procedure.

### Disclosures

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