Minimally Invasive Levator Advancement: A Practical Approach to Eyelid Ptosis Repair

Hector McDonald, M.B., B.Ch., F.R.C.S.C.¹

ABSTRACT

There are many established plastic surgical techniques to effectively address blepharoptosis. Minimally invasive levator advancement (MILA) causes limited disruption to the anatomy while maintaining good height, contour, lid folds, function, and long-term stability. This procedure has been performed in more than 1000 patients since 1993 by the author with consistent, durable results and is a reliable method to correct blepharoptosis. It is not indicated in cases with absent to very poor levator function, where frontalis suspension is the preferred procedure. The MILA technique will be described and illustrated.

KEYWORDS: Minimally invasive levator advancement (MILA), classic levator advancement (CLA), avascular pyramid, attenuated levator aponeurosis, orbicularis shift

Eyelid ptosis is also known as blepharoptosis and is essentially a drooping upper eyelid or eyelids. The most common complaints at presentation are asymmetry of upper lid height, awareness of a “smaller eye,” or droopy eyelids affecting vision.

Ptosis can range from a minimal cosmetic problem to varying degrees of occlusion of the pupil that results in a visual field defect and even failure of normal vision to develop in the pediatric population.

Many conditions can masquerade or present as ptosis, and it is essential for the ptosis surgeon to be aware of the potential pitfalls. A few conditions will be mentioned instead of giving the classification of ptosis, which has been covered superbly by other authors.^{1–3}

Most notable is the acute-onset ptosis associated with neurovascular conditions affecting the third cranial nerve and its pathway (trauma, aneurysms, arteriovenous fistulas, ischemic infarction, meningitis, vasculitis, tumors, infections [mucormycoses, zoster], metabolism [diabetic oculomotor palsy], ophthalmoplegic migraine, and nonspecific orbital inflammation).

Less acutely, one must be aware of Horner’s syndrome, essential blepharospasm, hemifacial spasm, floppy eyelid syndrome, synkinetic jaw winking, trauma, tumors having a mechanical effect, myopathies (oculopharyngeal dystrophies), multiple sclerosis, myasthenia gravis, and progressive external ophthalmoplegia, along with orbital volume loss, hypotropia, guarding from ocular surface disease and contra lateral eyelid retraction or proptosis as seen with Grave’s ophthalmopathy (pseudoptosis) and giant papillary conjunctivitis with contact lens usage.

Occasionally brow ptosis exacerbates any dermatochalasis, effectively causing a mechanical ptosis. Under these conditions the ptotic lids can improve with correction of either the brow ptosis or with a blepharoplasty alone.

Most of the cases of ptosis one sees are a result of a local problem with levator muscle and its aponeurosis. Needless to say, a thorough history and evaluation is always necessary. One should either have the ophthalmological background to assess the difficult cases or refer the patient for the appropriate evaluation prior to considering surgical repair. Congenital ptosis in the

¹Department of Ophthalmology, University of Ottawa, Ottawa Ontario, Canada.

Address for correspondence and reprint requests: Hector McDonald, M.B., B.Ch., F.R.C.S.C., 700 Hillside Road, Ottawa, Ontario, Canada K1L 8L2. E-mail: hmcDonald@revisage.ca.

Periocular Aesthetics; Guest Editor, Charles N.S. Soparkar, M.D., Ph.D. *Semin Plast Surg* 2007;21:41–46. Copyright © 2007 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662. DOI 10.1055/s-2007-967747. ISSN 1535-2188.

pediatric population should be referred to someone with the experience to repair and follow these children ophthalmologically.

HISTORY AND EXAMINATION

It is usually easy to see if a lid or lids are ptotic. Patients will describe worsening of the ptosis with fatigue and consumption of alcohol. Impaired superior visual field defects can result in minor head injuries. Patients are usually unaware of the chronic brow elevation with rhytids, fatigue, and headaches being precipitated by their ptosis. The chin-up position can cause neck pain. A detailed ocular history including any strabismus, cataract or intraocular surgery, infections, trauma, dry eyes, and contact lens wear should be taken.

Before evaluating the actual lid position and function, the brow and its frontalis muscle should be relaxed and held in the neutral position. Failure to do this can result in the contraction of frontalis masking as much as 4 mm of ptosis.

Look at the level of the upper eyelid margins in relationship to the pupillary margin. This can be done with the patient sitting upright and looking straight ahead. A good idea is to get them to follow your finger in to their maximum field of up gaze, and there again you can check their lid margin pupillary distance and at the same time evaluate the strength of levator. Sometimes this can be a problem after intraocular surgery or trauma that has resulted in asymmetric pupils. You can then use a flashlight to assess the lid margin pupillary light reflex distance. At the same time, assess for Bell's phenomenon.

Pupillary reaction to light should otherwise be equal; if not, this warrants further investigation. Then measure the levator function. Using a ruler, measure the full excursion of the upper eyelid margin with both eyes open from extreme down gaze to extreme up gaze. Absent to very poor function is described as 0 to 2 mm. Under these conditions in the presence of severe ptosis, a frontalis suspension should be considered. Otherwise the levator can be advanced to repair minimal to severe ptosis with poor to excellent levator function or any combination thereof.

A high crease indicates attenuation of the levator aponeurosis. Check upper eyelid horizontal lid laxity. This occurs in people who rub their eyes frequently or have floppy eyelids. There is poor eyelid contact with the globe and difficulty in getting a good contour when advancing the levator. This is an important observation as failure to correct it can exaggerate peaking of the upper lid margin after levator advancement. Any evidence of a poor tear film, proptosis, enophthalmos, and the presence of orbital or periocular tumors should be ruled out.

Once you and the patient are happy to proceed with the ptosis repair, an informed consent should be

obtained from the patient. This should include any other concurrent procedures being contemplated like blepharoplasties and horizontal lid tightening.

A safe and practical approach to levator advancement using a minimally invasive technique of advancing levator follows.

PREOPERATIVE EVALUATION

Indications for minimally invasive levator advancement (MILA) are similar to classic levator advancement (CLA). It can be performed at the same time as a blepharoplasty or lash ptosis repair. It is also advantageous in ill patients, touch up blepharoplasties, and isolated medial or lateral ptosis. It is not indicated in severe ptosis with absent to very poor levator function (0 to 2 mm).

I noticed many years ago that when the lids closed, the upper eyelid moved medially. This was more pronounced as the patients got older. I called this "orbicularis shift." It is of some importance in marking the area of suture placement, and you should realize that the placement of the suture will actually be medial (while the eye is closed) to your markings while the eye is open in primary gaze.

Aim for the suture to be placed just medial to the center of the pupil in uncomplicated ptosis to create a normal contour—this can vary if trying to achieve symmetry in atypical cases. Get the patient to look straight ahead and make a small mark just beneath their brow that is aligned with the medial aspect of their pupil. Ask them to close their eyes and place three dots in the crease slightly medial to the initial mark beneath the brow, taking into account the amount of orbicularis shift. This is for the anticipated skin incision.

ANESTHESIA

Sedation is seldom if ever required; 0.25 mL of 2% lidocaine with 1/100,000 epinephrine is infiltrated along the crease, and 0.25 mL is used to elevate skin and orbicularis over tarsus. This provides adequate anesthesia without affecting levator function. The longer the anesthesia is left in before surgery, the more likely you are to get some epinephrine affect on Mueller's muscle, partially correcting the ptosis. This might cause one to undercorrect surgically. A drop of topical anesthesia is instilled to prevent any ocular discomfort if the skin prep should seep into the eye.

Educate the patient prior to giving the injection. Tell them not to hold their breath as any valsalva may result in bruising and hematoma formation. Get them to open their eyes and look inferiorly. At the same time, elevate the brow with your thumb. This helps lift the lid skin off the globe, making it easier and safer to inject the

patient. I prefer to use a 3-mL syringe and a half-inch 30-gauge needle.

SURGICAL ANATOMY

To appreciate the difference between CLA and MILA, the upper eyelid anatomy will be briefly reviewed.

The CLA approach is through skin, orbicularis muscle, septum, preaponeurotic fat, and finally levator aponeurosis. MILA is only through skin and orbicularis to levator aponeurosis overlying the tarsal plate (Fig. 1).

Levator dehiscence and disinsertion has been the classic teaching. In fact, levator is always present over the tarsus. The pathology is attenuation of the aponeurosis, not dissimilar from the findings in hernias elsewhere. The only exception to this is the disinsertion of levator aponeurosis by traumatic or iatrogenic means.

SURGICAL TECHNIQUE OF MILA

I originated this procedure in 1993 and introduced it to Dr. Brad Lemke in January 1996. Dr. Mark Lucarelli, Dr. Lemke's fellow, presented his ASOPRS thesis on small incision ptosis in 1997. I presented my initial findings to a ptosis group at the American Academy of Ophthalmology in 1997 at Dr. Lemke's request (Brad Lemke, MD, written correspondence, May 1997). Since then Frueh and colleagues⁴ and Lucarelli and Lemke^{5,6} have reviewed their data on ptosis repair using a smaller incision technique. Their work has shown that the less we disrupt the anatomy, the more favorable the results are.

CLA has been the gold standard of levator advancement in acquired ptosis.⁷⁻⁹ So how does MILA differ from CLA? MILA is not CLA with a smaller incision.

Both approaches are through a crease incision. The challenge with MILA is getting from the crease to levator above tarsal plate. This is achieved by the formation of an avascular pyramid. A 10- to 15-mm crease incision is made through skin only and then

Figure 2 Skin incision is made.

cauterized (Fig. 2). Then with a pair of 0.5-mm forceps, the central inferior margin of the skin incision is grasped and elevated anteriorly, forming the pyramid. The superior triangle of the pyramid is the orbicularis. The medial and lateral triangles are composed of skin and orbicularis (Fig. 3). The floor of the pyramid is made up of an apex inferiorly and a base superiorly. The apex and the base are bounded by the vascular arcades. The floor is aponeurosis overlying and inserting into tarsus. The pyramid is then entered by spreading the exposed orbicularis apart superiorly while aiming for the avascular floor (Fig. 4). It is important to stay away from the arcades. Blunt dissection is performed until the glistening aponeurosis is seen overlying the tarsus (Fig. 5).

The levator is grasped in the middle of tarsus with fine forceps, and using a Westcott pair of scissors, an incision is made through aponeurosis. The patient is encouraged to look down, and the lid is elevated off the globe as the closed Westcott scissors are directed under aponeurosis and swept underneath but above Mueller's muscle and from side to side while still holding aponeurosis. The patient is then asked to look up as you feel the pulling of levator. At this point with closed Westcott scissors, the septum can be bluntly dissected off the

Figure 1 Surgical anatomy of CLA and MILA.

Figure 3 Formation of the avascular pyramid.

Figure 4 Entering the avascular pyramid with blunt dissection. Aiming for the "floor" and avoiding the arcades.

aponeurosis superiorly. This is essential in ensuring that the septum never gets snared in the advancing suture (Fig. 6). This step is applied in a similar fashion to Asian eyelids.

I have used a 7-0 Prolene suture either on a P1 or P6 needle. Once again, make sure the patient is looking down and the lid is elevated off the globe. One usually breaks the suction and you hear a small sucking sound as the eyelid is lifted off the globe. This is crucial in avoiding inadvertent passage of the needle through tarsus and conjunctiva into the globe, an important point in teaching ptosis surgery. The needle is then passed through 50% of the depth of tarsus parallel to the upper lid margin approximately in the middle of tarsus (Fig. 7).

The aponeurosis is then pulled inferiorly and the 7-0 Prolene suture is passed inferiorly through aponeurosis at a height thought to be appropriate for the severity of the ptosis. The tip of the needle is always visible, and this step should not be performed blindly (Fig. 8). The suture is temporarily tied, and the patient is asked to open their eyes as you evaluate symmetry of

Figure 5 Floor of pyramid visible showing shiny white aponeurosis.

Figure 6 Isolating and identifying levator.

height, contour, and lid folds (Fig. 9). This can be achieved while the patient is still supine as long as you get them to look up and behind them while neutralizing frontalis contraction. If in doubt, get them to sit up and evaluate the operated lid. The lid should also be checked while closed. Significant lagophthalmos might suggest entrapment of the septum.

Figure 7 Placement of suture through tarsal plate. Note the lid has been lifted off the globe.

Figure 8 Passing suture through levator aponeurosis.

Figure 9 Suture tied temporarily while assessing eyelid height contour and folds.

If you are satisfied, tie the suture permanently and cut the ends short to prevent later penetration through skin. If not, adjust the height accordingly and even add extra sutures medially or laterally as necessary until the desired contour and height is achieved.

The skin is closed with a superficial running suture using the same 7-0 Prolene. There is no need to approximate the orbicularis (Fig. 10).

DISCUSSION

I have performed this procedure on well over a thousand patients over a 12-year period. A scientific review of my data has not been done. Independent studies have been done by Drs. Frueh and Lemke outlining overall better outcomes with small incision ptosis repair on their patients than with the classic large incision levator advancement procedure.⁴⁻⁶ The emphasis of MILA is on the approach to levator, which has already been outlined. The emphasis should not be on the size of the incision—some surgeons are led to believe it is merely advancing levator in the classic fashion through a smaller incision.¹⁰ In actual fact, the MILA approach

can be performed through small incisions as well as through large blepharoplasty incisions. The point is to spare the anatomy—the size of the incision does not matter. A small incision can always be expanded to accommodate more sutures as may be required to get the right contour.

Peaking can and will occur if horizontal lid laxity is not corrected. It will also occur if overzealous advancement is attempted in a lid with poor levator function. Always anticipate the unmasking of contralateral ptosis after unilateral repair (Hering's law). Sometimes with bilateral ptosis, it is easier to repair each side a few days apart to be able to assess the effect of Hering's law and deal with it.

The most common complication is undercorrection. Aim a little higher to take into account any epinephrine effect. Reoperation is easy to do and should be done sooner rather than later to achieve symmetry.

Patients should be advised never to rub their eyes as this may result in recurrence of the ptosis. They should be encouraged to wear an eye shield whenever they sleep for the first 14 days postoperatively.

Skin closure can be achieved with any suture. My preference is 7-0 Prolene, which is removed after 1 week. During that time I ask patients to apply a steroid antibiotic combination with a cotton-tipped applicator to the skin sutures at least twice a day. No postoperative infections have been documented over the 12-year period.

The favorable outcomes may be attributed to the minimal disruption of the eyelid anatomy. The role of the septum has not yet been studied, and it may play a larger role in lid function than was previously thought.

Patients can stay on anticoagulants. Bleeding may occur if more than the two recommended incisions are made (the initial skin incision and the opening into aponeurosis over tarsus). The rest is by gentle blunt dissection. Avoidance of the vascular arcades is mandatory. If bleeding does occur, a cotton-tipped applicator is inserted into the wound and gentle pressure is applied. If cautery is needed, it is best administered with a fine-tipped unipolar needle. There is no downtime for the patient, but they are advised to take it easy for the first 48 hours postoperatively.

MILA is strictly for advancing levator aponeurosis in a safe and effective way. The procedure does not correct dermatochalasis or lash ptosis. These can be addressed at the same time as MILA through traditional surgical techniques.

The skin incision should be placed appropriately to disguise the scar in the crease. If unilateral, try to match the contralateral normal crease. If bilateral, aim for symmetrical heights. The advancement of levator determines the crease rather than the position of the incision.

Figure 10 Closure of wound.

Studies show no statistically significant difference in reoperative rate for correction of eyelid height when compared with CLA. I have found the reoperative rate depends on surgical judgment and technique at the time of surgery. The contour that is achieved appears to be superior to the CLA approach. The surgical time is reduced significantly and can be done in less than 3 minutes under optimal conditions. The anatomy is preserved, making subsequent surgeries much easier.

The incision can be expanded either medially or laterally at the time of surgery if more tarsal sutures need to be placed to adjust the contour of the lid.

Due to the minimal invasiveness of the procedure and the negligible postoperative morbidity, the MILA technique lends itself to being performed on sick individuals who would not otherwise be considered for ptosis surgery.

MILA is a safe, effective, and efficient means of advancing levator with at least 2 mm of levator function. This procedure causes minimal disruption to the anatomy while maintaining good height, contour, lid folds, function, and long-term stability.

REFERENCES

1. Frueh BR. The mechanistic classification of ptosis. *Ophthalmology* 1980;87:1019–1021
2. Beard C. *Ptosis*. 3rd ed. St. Louis, MO: Mosby Co.; 1981
3. Dutton JJ. *A Color Atlas of Ptosis*. Singapore: PG Publishing; 1989
4. Frueh BR, Musch DC, McDonald HM. Efficacy and efficiency of a small-incision, minimal dissection procedure versus a traditional approach for correcting aponeurotic ptosis. *Ophthalmology* 2004;111:2158–2163
5. Lucarelli MJ, Lemke BN. Small incision external levator repair: technique and early results. *Am J Ophthalmol* 1999; 127:637–644
6. Burkat CN, Lemke BN. Small incision levator repair revisited: technique, long term results. Presented at the 2005 ASOPRS Scientific Symposium; Chicago, IL; October 15, 2005
7. Jones LT, Quickert MH, Wobig JL. The cure of ptosis by aponeurotic repair. *Arch Ophthalmol* 1975;93:629–634
8. Anderson RL, Beard C. The levator aponeurosis. *Arch Ophthalmol* 1977;95:1437–1447
9. Anderson RL. Aponeurotic ptosis surgery. *Arch Ophthalmol* 1979;97:1123–1128
10. Jordan DR. Correcting aponeurotic ptosis. *Ophthalmology* 2006;113:163–164