Orbicularis-Levator Fixation in Double-Eyelid Operation

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One of the characteristic features of the East Asian person's eyelids is the lack of a supratarsal fold. A relaxed upper eyelid skin, due to the lack of supratarsal fixation, causes coverage of the tarsal margin of the upper eyelid. Thus the palpebral fissure looks smaller, giving a slit-eye appearance. Unlike those lids with a natural supratarsal crease, the levator palpebrae muscle and/or aponeurosis does not extend and attach to the pretarsal skin. The purpose of the double-eyelid operation is to create a supratarsal fold in the eyelids of Asian patients. Numerous surgical procedures have been developed to establish adherence between the levator aponeurosis and the eyelid skin. There are 2 main goals for this procedure: (1) a smooth, tight skin below the newly created supratarsal crease and (2) firm fixation between the levator aponeurosis and the skin to prevent relapse to a single eyelid. Most procedures described rely on loose cicatrization between the skin and the levator aponeurosis.

The surgical procedures can be grouped into the nonincisional suture technique and the incisional fixation technique. In the suture technique, the compressed tissue within the suture creates a scar that causes adhesion. Although a permanent suture material is used for the fixation between the skin and the tarsal plate, the suture itself does not hold tissue for long. As a result, the adhesion created by the suture technique is somewhat loose and recurrence is a frequent problem.

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The incision technique differs in that the incision is made along the proposed line of the supratarsal crease. The upper and lower lips of the skin edges are sutured to the levator aponeurosis attempting a cicatrical fixation between the skin and the aponeurosis. This provides for a more solid fixation and a lower recurrence rate. With the suture technique, considerable relaxation is expected owing to a rather flimsy cicatrical adhesion. Thus, the supratarsal crease is placed higher in the eyelid to compensate for the natural relaxation. It is not unusual to see the sutures made 10 to 11 mm from the ciliary margin, the average height of the supratarsal crease for the Caucasian. The Caucasian eyelid, however, is tightly bound to the underlying tarsus, allowing the pretarsal skin to remain in place when the eyelid is raised by thelevator muscle. In contrast, the eyelids of Asians lack this adhesion of pretarsal skin to the tarsus. As a result, the pretarsal skin droops as the eyelid rises. With the suture technique, this 10- to 11-mm distance is often reduced to 4 or 5 mm when the eyelids are raised. The double eyelid then exhibits a somewhat less well-defined crease with puffy and wrinkled pretarsal skin.

The incisional fixation technique gives a firmer fixation. However, each time the eye opens, a strain develops between the eyelid skin and thelevator aponeurosis. As a result, even the scar from incisional fixation lengthens with time. This causes a similar drooping of the supratarsal crease toward the eyelash, which results in a less distinctive supratarsal crease and a thicker, wrinkled pretarsal skin. I developed the orbicularis oculi muscle–levator aponeurosis fixation (orbicularis-
METHODS

About 30 minutes prior to the procedure, the patient is premedicated with alprazolam (Xanax; Upjohn Inc, Kalamazoo, Mich), 1 mg, the combination drug propoxyphene naprosate (100 mg)—acetaminophen (650 mg) (Darvocet N-100; Purpeac Pharmaceutical Co, Elizabeth, NJ), 1 tablet, and cephalaxin, 500 mg. While waiting for the medication to take effect, the eyelid is marked for the incisions with the patient in a sitting position. A surgical loupe is used for magnification. A fine-point, felt-tipped pen is used to draw the line. With the patient’s eye closed, the eyebrow is gently lifted to stretch the eyelid skin. Using a caliper for measurement, a dot is placed at about 6 to 7 mm from the ciliary margin. While the eyelid is stretched, a line is drawn medially and laterally to the extent of the palpebral fissure parallel to the tarsal margin. In the medial canthal area, the line continues when the Z-epicanthoplasty is necessary (unpublished data, 1998). The patient is then allowed to open the eyes to reveal the marking. When the eyes are open, the marking usually ends up at the level of the tarsal margin. The laxity of the eyelid skin will determine, to a great extent, how much skin is going to fall over the new crease. The eyelid with lax skin will have a marking right at the tarsal margin when the eyes are open. The eyelid with tight skin will have this line somewhat higher, still only about 1 mm from the ciliary margin. A broken wooden Q-tip is used to gently retract this marking against the tarsus in a superior direction to simulate the surgical result. This will allow the surgeon to estimate the height of the double fold. Only a single line is needed for preteens or patients in their early 20s with tight eyelid skin. For the eyelid with redundancy, often found in patients older than 30 years, the elliptical area of skin is marked for excision.

The patient is then taken to the operating room and placed in the supine position. The sterile preparation is usually done prior to the marking to prevent erasure. It is extremely difficult to match the eyes once the marking is erased, and it is important to keep the marking intact since the local anesthetics distort the skin. The local anesthetic used is 2% lidocaine hydrochloride with 1:100,000 epinephrine in a 1:1 ratio injected through a 30-gauge, 1-in needle. The injection is done in 2-layers, one right under the dermis and the second under the orbicularis oculi muscle. The incision is then made through the skin.

Once the incision spreads the skin edges apart, the carbon dioxide laser with a 0.3-mm Luxar near-contact tip (Bothel, Wash) is used to completely transect the orbicularis oculi muscle. The wound is then stretched open with 2-prong sharp retractors to reveal the areolar tissue fibers underneath. There is little or no fat between these 2 structures. A fine-tipped iris or tenotomy scissors is used to spread this areolar tissue. The dissection continues through the orbital septum (Figure 1). As the dissection gets deeper, a thin capsule surrounding the preaponeurotic fat becomes apparent; there is a loose space between the preaponeurotic fat and the septum. A tip of the scissors is introduced underneath this penetrated septum. The orbital septum is divided laterally and medially to expose the entire levator aponeurosis. When the thin capsule over the fatty tissue is left uninterrupted, the levator aponeurosis can be seen just underneath the fatty compartment. Once the scissors penetrates the thin capsule of fatty tissue, the fatty tissue may bulge out extensively and must be retracted to expose the levator aponeurosis. When this capsule is divided, the levator aponeurosis is more widely exposed as a pearly white, glistening membrane clearly distinguishable from the orbital septum (Figure 2).

It is important to divide the orbital septum all the way to the orbital margin both medially and laterally. As it approaches each end, the dissection plane becomes deeper, following the curvature of the eyeball. Near the medial canthal area, the fatty tissue tends to cover the levator aponeurosis more abundantly, and large capillaries and small arterioles are encountered near the medial and lateral extreme. Coagulation with the laser often helps to expose the levator aponeurosis clearly in this area. Near the lateral canthal area, the levator aponeurosis is just as firm as at the midpupillary point. In the medial canthal area, the aponeurosis is weaker and at times indistinguishable from fatty tissue. Complete exposure of the levator aponeurosis is key to the success of this operation. The pretarsal orbicularis oculi muscle extends about 3 to 4 mm beyond the skin incision (Figure 3). This thick muscle is grasped and the needle is passed through. Unlike the suture through the skin, the suture through this thick muscle can hold tissue for a much longer postoperative period. There is a loose areolar tissue between the orbicularis oculi muscle and the tarsus. The needle, passed from underneath the muscle over the tarsus, comes out to the surface of the orbicularis oculi muscle right at the skin incision margin (Figure 4). Although there is virtually no dermis available to grasp, sutures placed closer to the skin edge give a better traction. The levator aponeurosis, approximately 5 mm from the supratarsal margin, is then grasped with the forceps creating a fold of tissue. The needle is passed through this fold of levator aponeurosis (Figure 5) allowing the knot to be buried. For this purpose, a 6-0 or 7-0 clear nylon suture is used. With the suture tied, the surgeon should make sure that the suture material does not strangulate either the orbicularis oculi muscle or the levator aponeurosis.

The first suture is placed at the midpupillary point. The second suture is placed near the lateral canthus right next to the orbital rim (Figure 6). The levator aponeurosis in this area is just as strong as at the midpoint (Figure 7). The third suture is placed in the medial canthal area. Because of the loose aponeurotic tissue in this area, the aponeurotic suture is placed somewhat higher, and a much deeper bite is taken so future relaxation can be compensated (Figure 8). Once the sutures are completed, the patient is asked to open and close the eyes. The surgeon should make sure that the tarsal margin does not evert excessively. When the suture through the levator aponeurosis is placed too high, eversion of the eyelashes causes an unsightly show of the tarsal margin, especially with the eyes open. Asian patients do not appreciate this result. Figure 9 demonstrates a loose pretarsal skin prior to the orbicularis oculi–levator fixation. After the fixation, the surgeon can see the pretarsal skin stretched as the orbicularis oculi muscle tightens through the pull of the orbicularis oculi–levator fixation (Figure 10). The skin edges are already in good approximation (Figure 11), even without any sutures. Skin closure is done with a 6-0, fast-absorbing gut suture in a continuous manner. The patient is then taken to the recovery room. Iced gloves are placed over sterile 4 × 4-in gauze pads for 30 minutes to 1 hour before discharge. Antibiotics are given for 2 days after the procedure. In most cases, pain medication is used only on the day of the operation. The patient is seen in 4 days for wound inspection.
levator fixation) technique to accomplish a solid fixation that reduces drooping of the supratarsal crease. The supratarsal crease becomes crisp and the pretarsal skin stretches tightly. The width of the double eyelid does not change substantially with time owing to the solid fixation. The recurrence rate has also been greatly reduced.

**COMMENT**

The supratarsal crease is a curvilinear wrinkle formed by a fixation between the eyelid skin and the levator aponeurosis. The eyelid above the crease is described as a supratarsal eyelid; below the crease, the pretarsal eyelid. As a person’s eyes open, the supratarsal crease invaginates and the supratarsal eyelid doubles on its own, forming a double-eyelid fold, which covers a portion of the pretarsal eyelid. The portion of pretarsal eyelid that is still exposed when the eyelid is open in the primary gaze position is described as the pretarsal show or height of the double fold. The shape and height of the double fold.
fold determines the aesthetic outcome of upper eyelid surgery for the Asian patient.

The eyelid skin is extremely thin and tightly bound to the underlying muscle. The skin and the orbicularis oculi muscle move as a unit; there is virtually no sliding between the skin and the muscle. This tight adherence is well demonstrated when one attempts to peel off the skin from the underlying muscle during a lower eyelid blepharoplasty through a skin flap. The pretarsal orbicularis oculi muscle glides over the tarsus smoothly. Between the undersurface of the pretarsal orbicularis muscle and the tarsus, there is only a loose areolar tissue. In the Caucasian eyelid, the pretarsal skin is thin and appears to be tightly bound to the tarsus. This is due to the adhesion of the pretarsal orbicularis oculi muscle and levator aponeurosis in the supratarsal location. This adhesion is caused by the aponeurotic expansion into the septi of the orbicularis oculi muscle and eventually to the pretarsal skin. In the eyelid of the Asian patient without a supratarsal crease, the elevation of the tarsus during eye opening causes sliding of the tissue over the tarsus due to the lack of supratarsal fixation. As the eye opens, the eyelid skin starts to droop over the eyelash covering, in some instances more than 50% of the eyelashes. It is a frequent surprise to learn that many Asian patients have long eyelashes, which are revealed when the droopiness of the eyelid skin is corrected through supratarsal fixation. When the pretarsal orbicularis oculi muscle is pulled up with forceps during the operation, the skin over the pretarsal muscle stretches, the droopiness over the eyelash disappears, and the skin becomes tight. While the muscle is stretched, it is difficult to pull the skin downward to induce any relaxation due to the tight adherence between the pretarsal skin and the orbicularis oculi muscle. This stretching maneuver of the orbicularis muscle is similar to the expansion of an accordion. I describe this as an accordion effect of the pretarsal skin/orbicularis oculi muscle complex.
The double-eyelid procedures previously described in the literature rely on fixation between the skin and/or dermis and the levator aponeurosis. The creation of the supratarsal crease is accomplished by suturing the pretarsal skin and/or dermis to the levator aponeurosis or orbital septum with absorbable or permanent sutures. This procedure was based on an anatomical study describing insertion of the levator aponeurosis to the pretarsal skin. However, the electron microscopy study on the insertion of the levator aponeurosis to the pretarsal skin showed no attachment into the skin itself. There has been a persistent problem with the suture splitting out because of its superficial placement. The fixation between the skin and/or dermis and the levator aponeurosis or septum is flimsy; the tissue included in the suture is only about 1 mm thick owing to the lack of tissue volume of the dermis of the eyelid skin. Sutures do not hold tissue for long, and there is a constant, forceful strain on the suture between the levator aponeurosis and the skin/dermis while the levator contracts. This may cause early disruption of the suture or, at the least, rapid lengthening of the adhesion.

The strain is great on the suture during the course of more than 1000 blinkings throughout a day. Blinking causes a forceful and jerky traction of the suture. Keeping the eyelid open also results in a constant strain pulling the sutures apart. The tissue within the suture site must work diligently to provide sufficient healing of tissue to resist this force. Because the tensile strength of the wound in the early stage of fixation is only about 10%, the most common problem is relapse of the double-eyelid operation due to lack of solid fixation. The skin/dermal-aponeurotic/septal fixation may dissolve quickly during the early healing stage. Successful cases may rely on the cicatricial fixation between the bulky pretarsal orbicularis oculi muscle and the levator aponeurosis in the supratarsal location following temporary suture between 2 muscles. This is probably why the removal of the bulk of the tissue at the incision site worked without suturing, possibly owing to more extensive scar formation, which provided fixation as good as skin/dermal—septal/aponeurotic fixation.

Some surgeons make the skin incision at around 10 mm from the ciliary margin. This incision often ends up with a favorable pretarsal skin show of about 2 mm when the eyes are open. What may have occurred with this incision is that a notable relaxation throughout healing shrinks the pretarsal show to about 2 mm from the ciliary margin when the eyelid has settled. Most surgeons probably became aware of this fact through experience and made incisions higher to compensate for excessive relaxation, a trained guesswork of sorts. The incision made in my procedure is at about 6 to 7 mm, yet the pretarsal show is still 2 mm because of a lack of relaxation of the supratarsal fixation. The guesswork is eliminated in this procedure. Regardless of the skin looseness, the initial fixation will maintain the height of the supratarsal crease. The height of the supratarsal crease incision varies depending on the laxity of the pretarsal skin and the preference of the patient as to the final width of pretarsal show. An elliptical area of skin can be excised when there is excessive laxity of the pretarsal skin.

The question of eyelash eversion deserves mention in regard to different suture techniques. The eyelash eversion is one of the compensatory maneuvers to prevent a relapse of the double-eyelid operation in the suture technique. When the dermis is sutured to the levator aponeurosis, the skin must roll over the orbicularis oculi muscle to reach the levator aponeurosis. As a result, the skin tightens and bends the entire tarsal plate, much like the string over a bow, causing a subtle concavity of the tarsus, which results in an elevation of the eyelashes. This eyelash eversion is an attempt to have more tissue adherence between the 2 tissues. This suture loosens up quickly and the eyelashes return to their normal position quite rapidly, causing relapse. In my technique, these compensatory maneuvers are not necessary because the skin stretch depends only on a solid fixation between the bulky pretarsal orbicularis muscle and levator aponeurosis (Figure 12). While the levator pulls the eyelid, this solid bulk fixation is heavy enough to resist lengthening of the adhesion. Especially with a permanent suture, it will provide enough time for solid fixation of over 90% tensile strength before any disruption can occur between the 2 tissues.

Excision of a strip of the orbicularis oculi muscle along the incision has been advocated. My technique requires a mass of pretarsal orbicularis oculi muscle for a solid and permanent fixation. When the orbicularis oculi muscle is sutured to the aponeurosis, there is about 4 mm of full-thickness muscle involvement within the permanent suture fixation. A large bite of levator aponeurosis is also taken within the suture fixation. Since the levator aponeurosis is folded on its own and wrapped

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Figure 12. The orbicularis oculi muscle—levator aponeurosis fixation. A broad effacement of 2 tissues is evident.

Figure 13. Well-preserved pretarsal eyelid skin tightness and the double-eyelid fold after the orbicularis levator fixation.
around the muscle in this suture technique, 2 broad surfaces of the muscle and the aponeurosis efface each other providing a firm adhesion (Figure 12). The suture is tied loosely, just enough to cause effacement between the orbicularis and the levator.

If a surgeon strangulates these 2 structures through tight suturing, the suture may cut through 2 structures quite rapidly through avascular necrosis and result in a loose fixation. Only 3 sutures are required to hold it quite satisfactorily. If the surgeon is concerned about fixation, he or she can add 1 or 2 additional sutures at an even distance for security.

CONCLUSION

The pretarsal orbicularis oculi–levator aponeurosis fixation technique provides a solid suture fixation that will outlast any other fixation technique. In my technique, the suture fixation provides more than enough time for complete tissue healing with a good tensile strength. The amount of pretarsal show is stable and predictable (Figure 13).

Accepted for publication February 9, 1999.


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