Modified Z-Epicanthoplasty in the Asian Eyelid

Jung I. Park, MD, PhD

Objective: To propose a new technique for eliminating the medial epicanthal fold of the Asian upper eyelid.


Setting: Facial plastic surgery private practice.

Patients: Four hundred seventy-five Korean American patients from 9 midwestern states with type 2 or type 3 medial epicanthal folds.

Conclusions: The majority of the East Asian population has type 2 or 3 medial epicanthal folds. Most surgeons avoid epicanthoplasty because of the fear of visible scar formation. Modified Z-epicanthoplasty is a safe and effective technique for eliminating the epicanthal fold during double-eyelid operations. Scarring of the medial canthal area has not been a problem with this technique.

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The epicanthal fold is an eyelid skin flap on the medial aspect of the eye covering the lacrimal lake. It descends over the lacrimal lake to attach the medial aspect of the lower eyelid. This flap does not affect ocular or lacrimal function (Figure 1).

The epicanthal fold is unique among the East Asian population. It is present at 3 to 6 months’ gestation in 100% of both Asian and non-Asian groups. In non-Asian individuals, it is present in only 2% to 5% of the general population. In the Asian population, the incidence of the epicanthal fold ranges between 40% and 90%, depending on the statistics.1,2 One other unique feature among East Asian eyelids is the absence of a supratarsal crease. As a part of cultural migration, the trend has been to transform the upper eyelid shape into one with a supratarsal crease. The upper eyelid, without the supratarsal crease, is termed a single eyelid. When the supratarsal crease is formed by means of an operation in Asian people, it is described as a double eyelid to distinguish it from an eyelid without a supratarsal crease. The eyelid skin of the single eyelid tends to droop beyond the tarsal margin owing to a lack of suspension/fixation of the upper eyelid skin by the supratarsal crease. This upper eyelid skin margin tends to cover a portion of the upper eyelash and narrow the palpebral fissure to some degree. When the upper eyelid skin margin is below the tarsal margin, the transition between the normally present epicanthal fold and the upper eyelid skin margin is a smooth arch that creates a narrow but almond-shaped palpebral fissure.

When the supratarsal crease is created by the fixation of the upper eyelid skin to the levator aponeurosis, the height of the upper eyelid skin increases.3 As the upper eyelid skin is drawn to a higher position, it creates tension on the skin of the epicanthal fold. As a result, the epicanthal fold becomes exaggerated and unnatural looking (Figure 2). The combination of the creation of the supratarsal crease and the tensed untreated medial epicanthal fold transforms a natural almond-shaped eye into an unsightly round eye. The preference among many patients and plastic surgeons is to maintain the natural beauty of the palpebral fissure, while the surgery improves the aesthetics of the eyes by giving an illusion of a larger, more open eye.

Numerous procedures have been described to eliminate the epicanthal fold. Most procedures are flawed by the creation of an unsightly scar in the medial canthal area. Despite the availability, the epicanthoplasty is rarely performed because of the fear of scar formation.

In 1996, I described Z-epicanthoplasty to eliminate the epicanthal fold without causing an unsightly scar.4 Z-epicanthoplasty was designed in such a way that all incisions are confined to the...
TECHNIQUE

In the majority of cases, modified Z-epicanthoplasty is performed in conjunction with the double-eyelid procedure. In a small number of cases, this is done on patients who already have a natural double fold or on those who previously underwent double-eyelid surgery but were left with a persistent epicanthal fold.

The surgery is performed with the patient under local anesthesia. The markings are made with the patient sitting up. The first marking is placed in the middle of the epicanthal fold to the point corresponding to the medial end of the lacrimal lake (Figure 3). A dot is placed. This point is described as A. Point B is the point of confluence of the epicanthal fold with the lower eyelid skin. This point is quite distinctive in most patients. However, there are patients who have a poorly defined point B. In that case, the surgeon will have to decide the appropriate location of point B. Point D is the medial end of the lacrimal lake (Figure 4). Since point A is a surface representation of point D, the length of AB and DB would be the same. Point C is placed medial to point A. The distance between points A and C is the same as lines AB and DB. In the original description of Z-epicanthoplasty, line AC was drawn as a horizontal bar. As a modification, it is designed as an oblique line toward the midglabella point. As shown in the diagram, it is 90° to the upper tarsal border at the medial canthal area (Figure 5). The length of AC can be equal to that of AB and BD. However, as a refinement, I often use aesthetic judgment as to how long AC should be. The goal is to create line EC parallel to the curve of the upper tarsal margin in the medial quarter of the supratarsal crease. Point E is somewhere on the medial aspect of the line drawn for the creation of the supratarsal crease. It is determined in such a way that line EC would form a smooth continuation of the line that forms a supratarsal crease. The flap is developed by making incisions through EAB and BD. EABD becomes an epicanthal flap. After this flap is rotated, line AB would overlap line DB without any tension. A piece of triangular skin, EAC, is excised and discarded. This triangle becomes a recipient site for flap EABD. When the flap EABD is rotated, longer line EAB meets shorter line EC at a more obtuse angle, ECA (90°). In the original design, with horizontal AC, the ECA angle is more like 45°. A portion of the flap, triangle ABD, may be partially excised to eliminate redundancy.

The most critical step of this procedure is developing flap EABD. Line DB has to be incised thoroughly down to the medial canthal ligament. The first incision is made with a No. 15 Bard-Parker blade tip pointing at point D, with the blade facing the surgeon. The epicanthal skin should be stretched tightly to avoid an irregular incision. A gentle pushing motion through line DB produces the initial incision (Figure 6). Often, a pair of fine-tipped te-notomy scissors are then inserted, with the tip being placed at point D. At times, repeated cuts over the medial canthal ligament are necessary to completely free this flap, while tip B of flap EABD is being gently pulled upward. As the flap is freed, the surgeon can feel a sudden release of the flap from the underlying medial canthal ligament.

When the flap elevation is done properly, the transposed flap will be situated and fit into triangle ECA comfortably without any suture (Figure 7). This will guarantee the healing of line EC without visible scarring. If a surgeon desires a more distinctive crease, flap EC can be undermined and flap EABD can be anchored to the deep soft tissue underneath flap EC. Fine, nonabsorbable, buried sutures (6-0 or 7-0 clear nylon) are placed between the flap and the deep tissue plane of the recipient upper eyelid. Every effort should be made to avoid placing the suture too superficially; otherwise, it may create a prolonged redness and, at times, even granuloma formation. When triangle EAC is removed, it should include the underlying muscle and a portion of fatty tissue, so that the recipient site will have sufficient space to accept flap EABD. A suture to approximate points A and D is made through the medial canthal ligament (Figure 8).

It is then necessary to debulk the subcutaneous tissue under flap BAC for patients with thicker eyelid skin. When line AB is sutured to line DB, it can create a step formation, if flap BAC is thicker than line DB, the lower eyelid skin. Finally, meticulous closure of the incision lines, without any tension, is of utmost importance. Lines DAB and DAC eventually fade away completely, leaving line EC as a continuation of the supratarsal crease.
vicinity of the thin upper eyelid skin of the epicanthal fold, so that when the surgery is completed the incision lines are well hidden. When the surgery is properly executed, there is little tension across the suture lines. The final scar is a fine line that will eventually fade away completely. These results are in sharp contrast to those of other techniques where tension is placed on the flaps and scar widening becomes inevitable with wound healing.

While unsightly scar formation has been avoided by use of the Z-epicanthoplasty technique, the outcome in certain cases has revealed a tendency for redundancy of the pretarsal skin to develop near the medial canthus and for convergence of a pretarsal double fold to occur toward the lacrimal lake. I present a modification of the previously described Z-epicanthoplasty to improve the parallel relationship between the supratarsal crease/pretarsal double-fold and the upper eyelid tarsal margin.

**RESULTS**

Experience with 160 cases of Z-epicanthoplasty was accumulated as of February 1995, and the technique was described in 1996. Modification of original Z-epicanthoplasty occurred through the years that followed. Four hundred fifteen cases of Z-epicanthoplasty and modified Z-epicanthoplasty were performed between February 1995 and February 1999. As experience increased, the number of modified Z-epicanthoplasty procedures performed has increased steadily, and the modified Z-epicanthoplasty became the procedure of choice. Two hundred ninety-seven cases of modified Z-epicanthoplasty were performed during this period. The modified Z-epicanthoplasty is now incorporated in approximately 80% of double-eyelid operations, except in patients without the epicanthal fold and those who wish to maintain the epicanthal fold for personal aesthetic preference. A tendency to develop a redundancy of the pretarsal skin near the medial canthus and a convergency of the pretarsal double fold toward the lacrimal lake was noticed in more than 20% of the cases in which the original technique was used. With the modified technique, this tendency has been reduced to less than 5%. Of 297 patients who underwent modified Z-epicanthoplasty, 3 patients reported visible scarring of the medial canthal area and 2 required revision. The scar resolved with steroid injections in 1 patient. Three patients experienced suture granulomas that resolved with removal of the suture materials. Temporary hyperemic incision lines have been experienced in the first year of development of this technique. This problem disappeared after the technique of completely freeing flap EABD was mastered. There were no cases of injury to the lacrimal canaliculi.

**COMMENT**

The epicanthal fold is classified into 4 types. Type 1 has no epicanthal fold. In type 2, the upper eyelid skin margin covers the tarsal border as it approaches the medial canthal ligament. The lacrimal lake is covered only partially in this type. In type 3, the upper eyelid skin margin curves over the lacrimal lake, covering the entire medial angle of the palpebral fissure (Figure 1). This fold joins the lower eyelid skin, creating an unsightly flap.
Epicanthoplasty is best indicated in the type 3 patient group, although the type 2 epicanthal fold can be managed as well. Type 4 is a rare anomaly where the lower eyelid skin crosses over the lacrimal lake, forming a reverse epicanthal fold.

The design of the original Z-epicanthoplasty is quite versatile. As long as point C is placed within the thin eyelid skin, any degree of epicanthal fold can be corrected. In the original description, line AC is drawn horizontally. However, this line can be drawn at different angles, moving point C toward point E. Modification of Z-epicanthoplasty (Park procedure) was developed to assure a formation of the supratarsal crease/double fold parallel to the tarsal border as it approaches the medial canthus. By placing point C closer to point E in an arc AC, the crease will be further away from the tarsal margin. The angle between the upper tarsal border and AC becomes 90°. Even though the original Z-epicanthoplasty procedure was designed to produce a fold parallel to the tarsal margin, cicatricial contracture tends to cause some degree of convergence of line EC toward the lacrimal lake. On the other hand, point C in the modified technique increases the height of the crease at the medial canthal area to match with that of the supratarsal crease at the midpupillary point. Modified line EC has a lesser tendency to converge toward point D.

While Z-epicanthoplasty is an excellent procedure with which to eliminate the epicanthal fold, I have found that the modified technique provides greater versatility and results that show more pretarsal skin in the medial quarter of the upper eyelid (Figure 9), more of a parallel fold following scar maturation, and more of an open look as a whole. In fact, this design can no longer be called Z-epicanthoplasty.

Unlike the original Z-epicanthoplasty, angle CAB, as shown in Figure 5, becomes almost a straight line. Line EAB is longer than line EC. It is sometimes necessary to trim tip B of flap EABD to avoid redundancy of the rotated flap EABD. Often the free-hand technique is used for this purpose. The procedure can be performed with or without excision of the upper eyelid skin during the double-eyelid operation. Changing point C while maintaining the same parallel relationship with the upper eyelid tarsal margin allows great versatility.

The key elements in the Park procedure are as follows: the most critical point is the placement of point A, which is a surface representation of point D. Point A is then sutured to point D. When point A is placed too medially, i.e., closer to the nose in relation to point D, then point A will have to be pulled laterally to meet point D before the 2 points can be sutured together. This will create tension. The tension will cause widening of the scar between AB and DB. Excessive scarring in this area will cause an unsightly foreign body–like spot, such as a “sand-in-the-eye” appearance. It is also important to make a straight line
between B and D. The local anesthetic causes swelling of this area. As a result, the incision made on top of the swelling may differ from the original marking. Unless the tissue adjacent to the incision is tightly stretched, the final incision can be wavy. Of particular concern is removal of the excess tissue from the part of the lower eyelid in the process of making incision BD. The gaping thus created between lines AB and BD could be another reason why the scar forms in this area.

The subcutaneous tissue under the incision line AB could be thicker than line BD, and as the incision approaches point D, there is virtually no soft tissue underneath point D. To compensate for the discrepancy between these 2 incisions, the soft tissue underneath the triangular flap CAB may be thinned. At times it is necessary to thin the soft tissue even beyond point C to create a smooth transition from the nasal skin to the lacrimal lake. Debunking with a laser or cautery serves this purpose well. This discrepancy between 2 incisions is less of a problem in a patient who lacks fatty tissue in the area between the medial canthus and the nose.

One of the most important aspects of the Park procedure is a thorough elevation of flap EABD. Without complete elevation, this flap is tethered to the portion of the lower eyelid near point D, resulting in an inaccurate transposition of the flap. The outcome of this inadequate surgery is the creation of a constant force pulling the flap backward, widening the scar along line EC and the persistence of an epicanthal fold.

CONCLUSIONS

Most Asian eyelids have type 2 or 3 epicanthal folds. A total of 415 cases of Z-epicanthoplasty and Park epicanthoplasty (Figure 10) were performed during the past 4 years. Epicanthoplasty was performed on selected type 2 cases. Generally, when the patient desired a so-called inner-type double-eyelid or small, conservative, double-fold surgery, the epicanthoplasty was not performed. The best candidates were those with type 3 epicanthal folds.

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Reprints: Jung I. Park, MD, PhD, 9305 Calumet Ave, Suite A-2, Munster, IN 46321.

REFERENCES