

Two-Z-Epicanthoplasty in a Three-Dimensional Model of Asian Eyelids

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Abstract

Background Epicanthoplasty is a procedure currently available for medial epicanthus correction. However, potential problems such as difficult designs, undercorrection, and unpleasant scarring in the medial canthus area make patients hesitant about undergoing epicanthoplasty. These barriers are challenges to surgeons.

Methods From January 2007 to May 2010, epicanthoplasty was performed for 23 patients using two-Z-plasty in a three-dimensional surgery model. A total of 20 patients underwent a simultaneous double-eyelid operation when required. The medial canthal distance was measured preoperatively and 12 months postoperatively. The extent of postoperative scarring and improvement of the epicanthal fold were evaluated after surgery.

Results The average intercanthal length decreased significantly from a mean of 37.0 ± 2.1 mm preoperatively to 31.4 ± 1.9 mm 12 months postoperatively ($p < 0.01$, paired t test). Epicanthoplasty yielded excellent aesthetic results in terms of an open medial canthus without definite relapse, hypertrophic scarring, and injury of the lacrimal apparatus during the 12-month follow-up period.

Conclusions Two-Z-epicanthoplasty can be reproduced easily in a three-dimensional surgery model. This procedure is very effective for correction of the epicanthal fold,

resulting in a pleasant-appearing, inconspicuous scar and a long-lasting outcome.

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Keywords Epicanthoplasty · Three-dimensional model · Asian eyelids · Epicanthal fold

The lack of a superior palpebral fold is a unique feature among Asians [1–3]. Blepharoplasty of the upper eyelids is one of the most commonly performed aesthetic procedures for Asians. However, an epicanthal fold is frequently encountered in the Asian patient void of the supratarsal crease, which tends to widen the interepicanthal distance and narrow the palpebral fissure. It is not easy to satisfy these patients by performing only a double-eyelid operation because after creation of a new supratarsal crease without epicanthal fold correction, the preexisting epicanthal fold can be exaggerated, with the eye shape taking on an unsightly rounded rather than a natural almond shape. The epicanthal fold then may be more obvious than before surgery and an unpleasant appearance accentuated. Therefore, it is mandatory to correct the epicanthal fold simultaneously, which will effectively improve the aesthetic result of double-eyelid surgery [3–7].

Numerous procedures for elimination of the epicanthal fold have been described in the medical literature including nasal root augmentation, L-skin reduction, and transposition flaps (e.g., Z flap, W flap, YV flap, Mustarde flap). Among these, transposition flaps are currently available procedures [4–15]. However, transposition flaps still have

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potential problems, such as a difficult design, undercorrection, and prominent scarring of the medial canthus and nasal areas, which limit the procedure's application. Sometimes the epicanthoplasty cannot be accepted because of unpleasant postoperative scarring in the medial canthus area.

In this report, we present our experience using two-Z-plasty to correct the medial epicanthal fold in a three-dimensional surgery model. The purpose of the procedure was to correct the epicanthal folds effectively and leave inconspicuous scarring with satisfactory results.

Materials and Methods

Patients

From January 2007 to May 2010, epicanthoplasty was performed using the two-Z-plasty method in a three-dimensional structure for 23 female patients with an

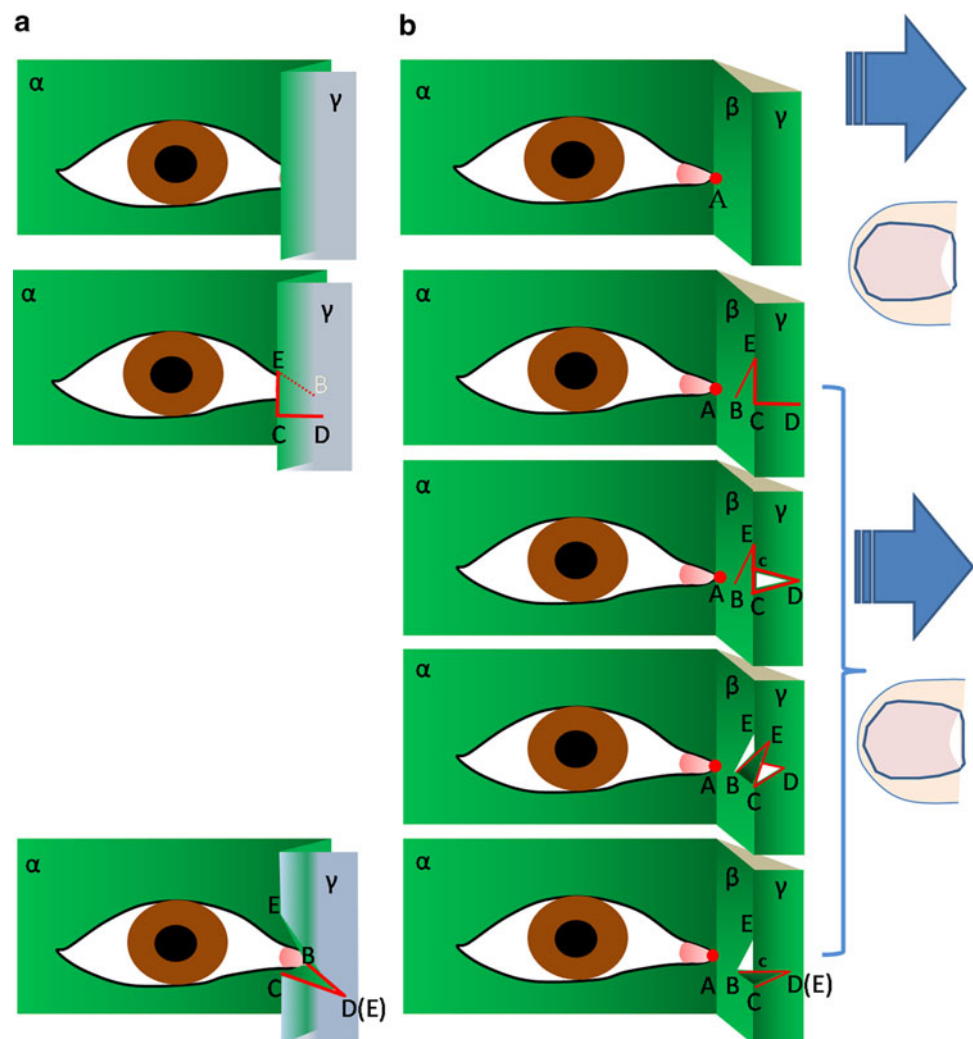
average age of 23.6 years (range, 16–33 years). For these patients, we performed an institutional board-approved retrospective review of our database. The follow-up period ranged from 1 to 3 years. Of the 23 patients, 20 underwent a simultaneous double-eyelid operation when required.

Surgical Techniques

Three-Dimensional Model of the Asian Medial Canthus

The three-dimensional structure of the medial canthus comprises three planes: the conjunctival membrane plane (α), the conjunctival membrane-skin plane (β), and the skin plane (γ), as shown in Fig. 1. When the medial epicanthal fold forms, the lacrimal caruncle on the α plane is covered by the skin of the eyelid on the γ plane. Correction of the epicanthal folds requires exposure of the lacrimal caruncle, which is covered by the skin on the γ plane in a three-dimensional model of the medial canthus.

Fig. 1 Schematic illustrating the design of the procedure, the first Z-plasty. Column **b** shows the design when the nose skin is pulled in the medial direction. In a three-dimensional model, the medial canthus comprises three planes: α (conjunctival membrane plane), β (conjunctival membrane-skin plane), and γ (skin plane). The medial canthus is covered by the β and γ planes (column **a**). After the nose skin has been pulled in the medial direction, the medial canthus (point *A*) is exposed (column **b**). In the first imbalanced Z-plasty, after the BCE and ECD flaps exchange their positions, the large part of the lacrimal caruncle is exposed



Incision Design

The surgical procedure is performed with the patient under local anesthesia lying in the supine position. First, point A, the actual hidden medial canthus, is marked on the medial-most point of the lacrimal lake (Fig. 1). Point D, which overlies point A, then is marked on the skin of the covering epicanthal fold. Point C is marked on the lateral border of the medial epicanthal fold at the level of a horizontal extension line from the subciliary area. Line CD then is drawn. Next, from point C, a line is drawn upward along the lateral border of the epicanthal fold to point E, which is marked such that the length of line CE equals the length of line CD. The nasal skin then is pulled in the medial direction, spreading the medial canthal fold and exposing the lacrimal lake. Extending from point A, line AB is marked as a horizontal extension of the subciliary margin such that the length of line AB equals that of BE.

Next, point F is marked on the skin covering the medial canthal region such that EF equals BE in length, and angle CEF is 45° . Line EF then is drawn. Finally, points A, B, and E all fall on the conjunctival membrane-skin plane (β), whereas points C, D, E, and F all fall on the skin plane (α), which covers the lacrimal caruncle on the conjunctival plane (γ). The triangle flap BEC is designed to move outward and medially as an interpolated flap (or half-Z-plasty), whereas the triangle flaps ABE and CEF are

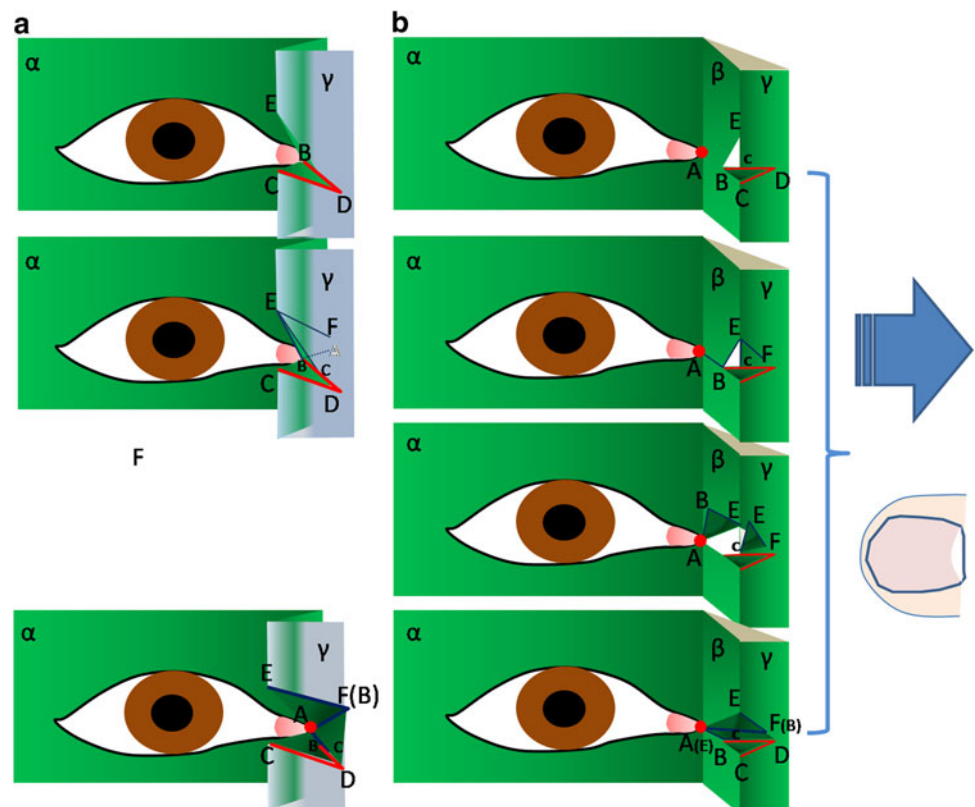
designed to exchange their positions from different planes (as a Z-plasty) to expose the hidden lacrimal caruncle (Figs. 1 and 2).

Operative Procedure

In our study, when the design was completed, 1% lidocaine with 1:100,000 dilution of epinephrine was injected. The surgical procedure included two Z-plasties. The first imbalanced Z-plasty was performed to expose the lacrimal caruncle. It was a half Z-plasty with a single 90° interpolated flap. The incisions were made along BE, CE, and CD. After the incision of CD, there was a triangular cutaneous deficiency due to the release of skin tension from vertical shortage. The local skin tissue flap BEC was raised up. By cutting and dissecting the dense connective tissue located between the skin and orbicularis oculi muscle in the medial canthal area, the associated skin tension was continuously released. The triangular flap BEC was transposed with a rotation of 90° medially without tension and inserted in the defect formed by the CD incision. The excessive skin of the medial canthus in the subciliary region was trimmed off along the subciliary incision. When the first Z-plasty (a half Z-plasty) was finished, the major part of the lacrimal caruncle was exposed.

In the second Z-plasty, the incisions were made along AB and EF. The local skin tissue flaps CEF and ABE were raised

Fig. 2 Schematic illustrating the design of the procedure, the second Z-plasty. Column **b** shows the design when the nose skin is pulled in the medial direction. In the second Z-plasty, after the ABE and CEF flaps exchange positions, the lacrimal caruncle is totally exposed



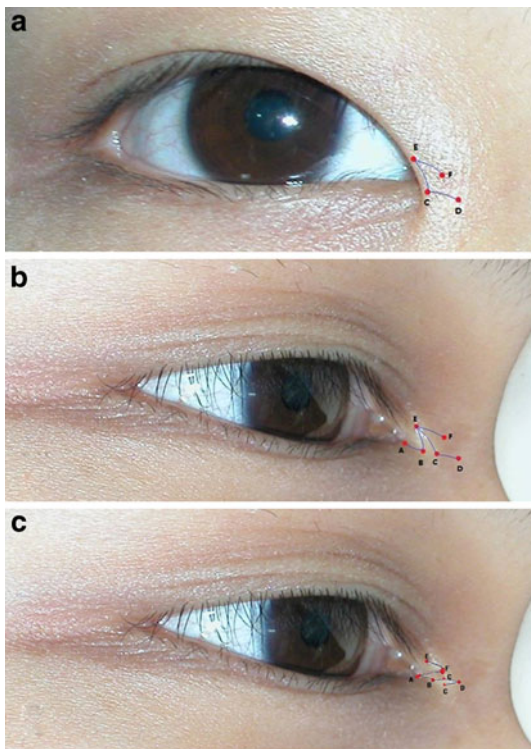
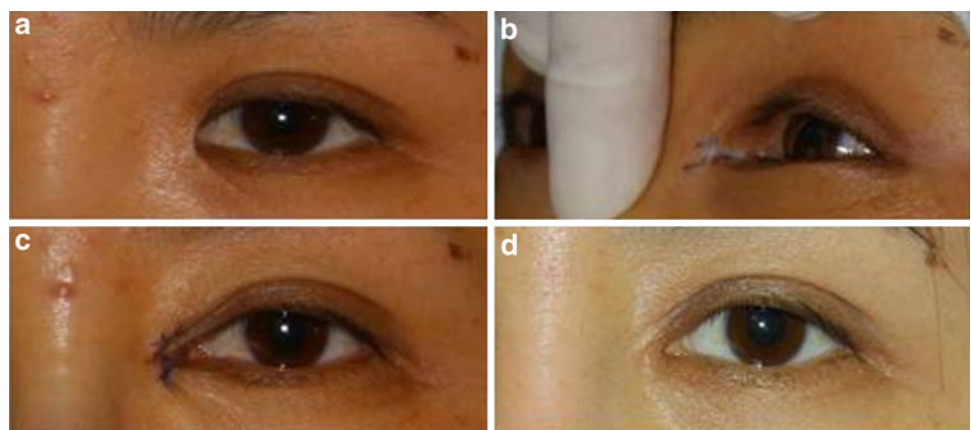


Fig. 3 Schematic illustration. **a, b** The incision design of two-Z-epicanthoplasty. **c** The result after flap redistribution

up. The triangular flap CEF was rotated laterally and posteriorly, and flap ABE was rotated medially. After the exchange of flaps ABE and CEF, the medial canthal angle opened more widely, and most of the epicanthal fold spontaneously disappeared. Finally, the ABE and CEF flaps were transposed onto the sagittal plane. The upper margin of the flap was aligned with the supratarsal fold line, and the lower margin of the flap was aligned with the lower eyelid edge, which made the incision inconspicuous. Finally, the wound was closed using 6-0 nylon stitches without tension, and the lacrimal caruncle was completely exposed. Double-eyelid

Fig. 4 a This patient had a severe medial epicanthus. Almost all of the lacrimal lake was covered by the fold. **b** The surgical design of two-Z-epicanthoplasty. **c** The epicanthoplasty was performed using two-Z-plasty. **d** Postoperative view at 12 months showing a pleasant-looking eye and no obvious scarring



plasty then could be performed when required. All sutures were removed on day 7 after surgery (Figs. 3 and 4).

Methods

The extent of postoperative scarring and the improvement of the epicanthal fold were reviewed using the method described later. The intercanthal length was recorded preoperatively and 12 months postoperatively. The cicatrix color, tone, and protrusion were evaluated as severe, moderate, mild, slight, or none. These ratings were recorded 2, 6, and 12 months postoperatively. Improvement in the epicanthal fold was evaluated as excellent, good, fair, or poor 1 year after surgery.

Results

The average intercanthal length decreased significantly, from a mean of 37.0 ± 2.1 mm preoperatively to 31.4 ± 1.9 mm 12 months postoperatively ($p < 0.01$ paired *t* test). In most cases, moderate or mild redness and protrusion of the scar were noticeable 2 months postoperatively but had disappeared by 6 months postoperatively.

Postoperative evaluation using a grading scale indicated “excellent” results for 19 patients and “good” results for 4 patients. No patients rated the results as “fair” or “poor.” All the patients with severe or moderate epicanthal folds were satisfied with the aesthetic results (Figs. 4, 5, 6, 7, 8, 9). No definite relapse, hypertrophic scarring, or injury of the lacrimal apparatus had occurred 12 months postoperatively.

Discussion

The epicanthal fold is present in 50% to 90% of East Asian adults [1, 2]. The cause of the epicanthal fold is not clear.

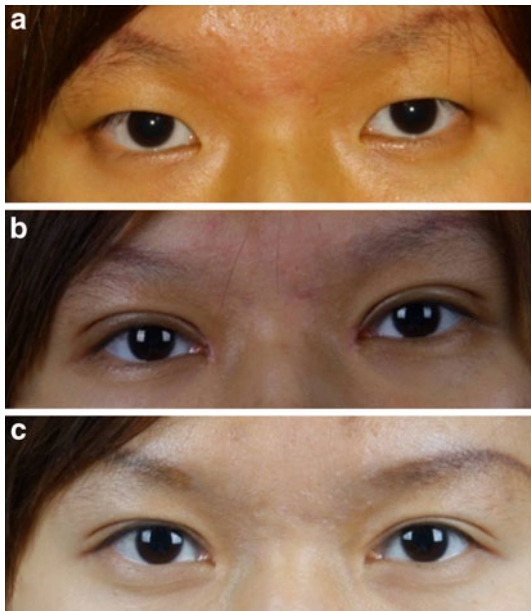


Fig. 5 A 22-year-old woman with mild epicanthal folds. The patient underwent simultaneous two-Z-epicanthoplasty and double-eyelid surgery. **a** Preoperative view. **b** A hypertrophic scar developed 2 months after the operation. **c** The scar faded 6 months after the operation, with satisfactory results



Fig. 6 This patient had a mild medial epicanthus and underwent two-Z-epicanthoplasty. **a** Preoperative view. **b** View 6 months after the operation. The scar in the medial canthal area is inconspicuous

Some reports attribute it to an underdeveloped nasal root, a malpositioned portion of the orbicularis oculi muscle fibers, horizontal skin excess, or vertical skin shortage in the medial canthal region [1, 16]. However, for a minority of East Asians, the epicanthal fold disappears as the nose develops between the fetal period and puberty. The epicanthal fold persists permanently in large sections of the East Asian population [1]. Correction of the epicanthal fold undoubtedly enhances the aesthetic outcome by lengthening the horizontal palpebral fissure, giving Asian eyes a clear, bright look [3–7].

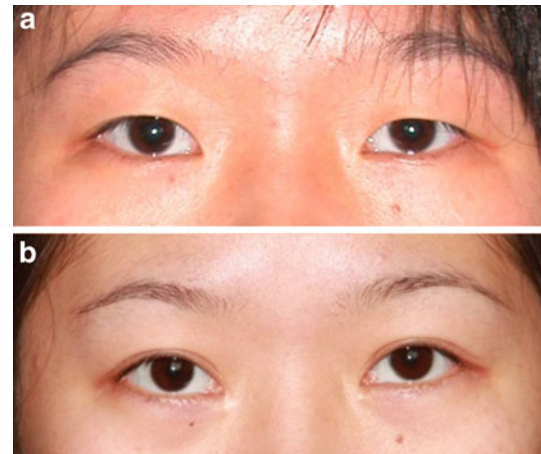


Fig. 7 A 20-year-old woman had no double-eyelid fold and a mild medial epicanthus. **a** Preoperative view of the patient awaiting double-eyelid surgery and two-Z-epicanthoplasty. **b** Postoperative view at 12 months in which the eye appears larger

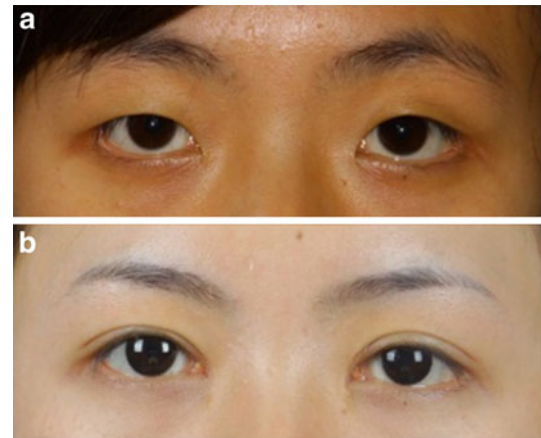


Fig. 8 **a** Preoperative view of a 20-year-old patient showing a moderate medial epicanthus and no double-eyelid crease. **b** Postoperative view at 12 months showing a pleasant-appearing eye after double-eyelid surgery and two-Z-epicanthoplasty

Although the medical literature shows that the underdeveloped nasal root is related to epicanthal fold formation, moderate augmentation rhinoplasty does not effectively correct the epicanthal fold [1]. Augmentation rhinoplasty can directly exhaust the excess of skin in the medial canthal area but cannot release the tension caused by vertical skin shortage. Therefore, moderate augmentation rhinoplasty can correct only the underdeveloped nasal root. It contributes little to correction of the epicanthal fold.

The transposition flap is the technique currently available for correction of the medial canthal fold. The epicanthal fold can be corrected after redistribution of fold skin by removal of horizontal redundant skin and lengthening of vertical skin. At the same time, the orbicularis oculi muscle of the medial canthal area can be released.



Fig. 9 A 23-year-old woman had no double-eyelid fold and severe epicanthal folds. The patient underwent simultaneous two-Z-epicanthoplasty and double-eyelid surgery. **a** Preoperative view. **b** View 1 year after two-Z-epicanthoplasty. The lacrimal caruncles are exposed. The surgical procedure showed excellent results, and the patient was satisfied with the aesthetic results

Many epicanthoplasty techniques have been described in the medical literature including simple or modified Z-plasty, W-plasty, VM-plasty, and the inverted Y-V or Y-V advancement method [4–15, 17–20]. These procedures can successfully eliminate the epicanthal fold. However, most epicanthoplasties are flawed by visible hypertrophic scars in the medial canthal area, which can be a problem and a main shortcoming. In particular, scarring of the nasal skin in Asians tends to become hypertrophic. This causes many surgeons desiring avoidance of conspicuous scarring to undercorrect the epicanthal fold and makes patients hesitant about undergoing epicanthoplasty.

Obviously, there is a crux in the use of these transposition flaps to correct the epicanthal fold. A small flap results in undercorrection, and a large flap can eliminate the epicanthal fold but leaves a prominent scar [1]. The incision on the thick nasal skin leaves an especially noticeable postoperative scar. However, the skin in the medial canthal area always blends into the adjacent nasal skin. The positions of the incisions are not easy to locate satisfactorily.

To date, the results of scar extension have been closely related to the judgments of the operators. The procedures require geometric planning and great experience to avoid unsightly scars. All procedures should be elaborately designed and meticulously performed.

Both the simple and complicated flaps described in the medical literature usually are designed within the skin plane. This makes it more difficult to design the incision and estimate the postoperative results because the epicanthal fold is a three-dimensional structure.

The methods suggested in this report clearly present the design step by step when the incision is drawn as a three-

dimensional structure comprising three planes: the conjunctival membrane plane, the conjunctival-skin plane, and the skin plane. With our proposed method, not only can the orbicularis oculi muscle of the medial canthal area be released, but the vertical skin shortage also can be thoroughly resolved. Additionally, with the three-dimensional surgery model, all the flaps were designed to be confined explicitly in the epicanthal fold region. Thus, an extensive incision on the thick nasal skin could be easily and effectively avoided.

This method also clearly displays the flap transfer procedure and presents the postoperative result directly and precisely in a three-dimensional surgery model. With our procedure, after transposition of the excessive horizontal skin flap from the epicanthal fold in the first step, a large part of the lacrimal caruncle is exposed. At the same time, the procedure relieves a portion of the shortage of the skin in the vertical direction when the BEC flap is inserted into the CD defect. However, if we simply stitch BE and EC, a new vertical line crossing the medial canthus is created, and a second epicanthal fold forms postoperatively. Recurrence of the epicanthal fold may sometimes occur. Thus, in the second step, another Z-plasty is mandatory. As a result, the vertical skin deficiency continues to be alleviated. In the front view, point D does not cover point A, and the lacrimal caruncle is totally exposed. The incisions are broken into a zigzag line, and there is no vertical line across the medial canthus. Recurrence of the fold is effectively avoided. Moreover, the incisions left on the coronal plane, CD and EF, are inconspicuous because they are parallel to the palpebral margin. Other flap incisions are invisible in the front when they are turned to the sagittal plane, which exists between the skin and conjunctiva.

Conclusion

Although the epicanthoplasty we present requires a two-Z-plasty and appears to be complex, it can thoroughly relieve vertical skin shortage and thus effectively prevent epicanthal fold relapse. In fact, it can be easily designed, controlled, and performed in a three-dimensional surgery model. Moreover, it is widely applicable to diverse types of epicanthal folds, resulting in a pleasant-appearing, inconspicuous scar and a long-lasting outcome.

References

1. Lee Y, Lee E, Park WJ (2000) Anchor epicanthoplasty combined with outfold type double eyelidplasty for Asians: do we have to make an additional scar to correct the Asian epicanthal fold? *Plast Reconstr Surg* 105:1872–1880
2. Fujiwara T, Maeda M, Kuwae K, Nishino K (2006) Modified split V-W plasty for enropion with an epicanthal fold in Asian eyelids. *Plast Reconstr Surg* 118:635–642

3. Wong JK (2009) Aesthetic surgery in Asians. *Curr Opin Otolaryngol Head Neck Surg* 17:279–286
4. Park JI (1996) Z-epicanthoplasty in Asian eyelids. *Plast Reconstr Surg* 98:602–609
5. Park JI (2000) Modified Z-epicanthoplasty in the Asian eyelid. *Arch Facial Plast Surg* 2:43–47
6. Yi SK, Paik HW, Lee PK, Oh DY, R JW, Ahn AT (2007) Simple epicanthoplasty with minimal scar. *Aesthetic Plast Surg* 31:350–353
7. Li FC, Ma LH (2008) Double eyelid blepharoplasty incorporating epicanthoplasty using Y-V advancement procedure. *J Plast Reconstr Aesthet Surg* 61:901–905
8. Kao YS, Lin CH, Fang RH (1998) Epicanthoplasty with modified Y-V advancement procedure. *Plast Reconstr Surg* 102:1835–1841
9. Lin SD (2000) Correction of the epicanthal fold using the VM-plasty. *Br J Plast Surg* 53:95–99
10. Cho BC, Lee KY (2002) Medial epicanthoplasty combined with plication of the medial canthal tendon in Asian eyelids. *Plast Reconstr Surg* 110:293–300 discussion 301
11. Yoo WM, Park SH, Kwag DR (2002) Root z-epicanthoplasty in Asian eyelids. *Plast Reconstr Surg* 109:2067–2071 discussion 2072–2073
12. Park JI (2003) Root Z-epicanthoplasty in Asian eyelids. *Plast Reconstr Surg* 111:2476–2477
13. Lee YJ, Baek RM, Song YT, Chung WJ, Lee JH (2006) Periciliary Y-V epicanthoplasty. *Ann Plast Surg* 56:274–278
14. Zhang H, Zhuang H, Yu H et al (2006) A new Z-epicanthoplasty and a concomitant double eyelidplasty in Chinese eyelids. *Plast Reconstr Surg* 118:900–907
15. Lu JJ, Yang K, Jin XL, Xu JJ, Zhang C, Zhang B, Teng L (2011) Epicanthoplasty with double eyelidplasty incorporating modified Z-plasty for Chinese patients. *J Plast Reconstr Aesthet Surg* 64:462–466
16. Jordan DR, Anderson RL (1989) Epicanthal folds: a deep tissue approach. *Arch Ophthalmol* 107:1532–1535
17. Oh YW, Seul CH, Yoo WM (2007) Medial epicanthoplasty using the skin redraping method. *Plast Reconstr Surg* 119:703–710
18. Yen MT (2007) Medial epicanthoplasty using the skin redraping method. *Plast Reconstr Surg* 120:1740
19. Wu W (2007) Re: simple epicanthoplasty with minimal scar. *Aesthetic Plast Surg* 31:354–357
20. Chen W, Li S, Li Y, Wang Y (2009) Medial epicanthoplasty using the palpebral margin incision method. *J Plast Reconstr Aesthet Surg* 62:1621–1626