

Revisional Asian Blepharoplasty of the High Eyelid Fold: Tarsus-Orbicularis Fixation Combined With Orbital Fat Repositioning Technique

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Background: Abnormally high eyelid fold is a common unsatisfactory esthetic outcome after double eyelid surgery. At present, successful correction of high eyelid fold among Asians remains one of the most challenging procedures for eyelid plastic surgeons.

Objectives: This article aims to propose a novel technique for correcting high eyelid fold to improve the cosmetic outcomes and patient satisfaction.

Materials and Methods: This is a retrospective study of 86 patients (154 eyelids) with high eyelid folds who underwent revision blepharoplasty. A new proper height incision line was designed during the operation, and the adhesion between skin and levator aponeurosis was fully released. The residual orbital fat was adequately separated. If necessary, orbital fat from lower eyelid will be harvested for free fat grafting. The tarsus-orbicularis fixation combined with orbital fat repositioning technique was used to create a double eyelid fold and reconstruct the gliding zone. The surgical outcome and patient satisfaction are reviewed.

Results: Among the 154 eyelids with high eyelid fold, mean lid crease height decreased from 9.8 mm preoperation to 6.8 mm ($P < 0.001$) and mean pretarsal show decreased from 3.5 mm preoperation to 1.9 mm 6 months postoperation ($P < 0.001$). The esthetic outcome was fully satisfied in 78 patients (90.7%) and basically satisfied in 6 patients (7.0%). Two patients (2.3%) were unsatisfied because of ptosis undercorrection in 1 patient and asymmetry in the other. They both got satisfied results after reoperation.

Conclusions: The tarsus-orbicularis fixation combined orbital fat repositioning technique is a simple and effective method to

correct high eyelid folds with high satisfaction and rare complications.

Key Words: Asian blepharoplasty, double eyelid, fat repositioning, high eyelid fold, secondary blepharoplasty

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Upper blepharoplasty is the most commonly performed procedure in Asian cosmetic surgery. There has been great progress in the field of double eyelid surgery since Mikamo first reported his suture method to create a lid crease in 1896. The methods had changed from suture technique to mini-incision technique and full-incision technique to create a natural-looking and steady eyelid fold.^{1,2} Although the vast majority of people obtained beautiful double eyelid folds after surgery, some patients appeared unsatisfactory and unacceptable complications. Unfortunately, the number of such cases is increasing rapidly year by year.^{3,4} Abnormally high eyelid fold comprised a large proportion of the complications and was the main cause of patients requiring revision operation. The high fold makes the upper eyelid unnatural-looking and causes the appearance of sleepiness and dullness. In China, this situation is often called “sausage eye” because patients with this symptom looked puffiness in their pretarsal area.⁵ Abnormally high eyelid folds are usually accompanied by deep folds, depressed scar, ectropion, blepharoptosis, multiple folds, asymmetry, sunken eyelids, lower flap tumidness, and eyelid heaviness (Fig. 1).³ These situations affect both appearance and physiological function of the eyes. In addition, it gives rise to a severe psychological burden on the patients.

Successful correction of the high eyelid fold among Asians is one of the most challenging procedures for plastic surgeons. So far, only a few papers published on Asian eyelid complications of high eyelid folds and their corrections. In 2016, Wattanakrai et al⁶ reported a novel technique in which levator advancement and secondary correction of high fold were performed at the same time. Kim et al⁷ in 2017 described a wide dual-plane

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FIGURE 1. Preoperative views of a 47-year-old woman after 2 previous surgeries with eyes open and closed. She had bilateral abnormally high eyelid folds, asymmetric folds, depressed scar, blepharoptosis, and sunken eyelids. The pretarsal shows before revision surgery were 4.3 mm (right) and 4.9 mm (left). The lids crease height was 11.8 mm (right) and 13.0 mm (left).

dissection technique to correct high double eyelid fold. Young et al⁸ in 2018 reported lowering of the high eyelid crease in revision upper eyelid surgery. In 2018, Guo et al⁵ published a paper on corrective strategies for a complex deformity caused by “European-style double eyelid” blepharoplasty in Asians. The main characteristics of this complex deformity are a high fold and a depressed eyelid. Liu et al⁹ in 2018 reported a technique of correction of the high eyelid fold using the pretarsal orbicularis oculi flap. In this retrospective study, we evaluate the surgical outcome of 86 patients (154 eyelids) with high eyelid folds, which were corrected by tarsus-orbicularis fixation combined with orbital fat repositioning technique.

MATERIALS AND METHODS

From August 2017 to June 2021, 86 patients (154 eyelids) with high eyelid folds were performed revision blepharoplasty. All the patients included in this study complained of unsatisfactory high eyelid folds from previous surgery. Patient exclusion criteria are as follows: patients with congenital blepharoptosis who had performed conjoint fascial sheath or frontalis suspension surgery, patients with obvious pretarsal orbicularis oculi muscle defect after previous surgery, patients with fewer orbital fat in both upper and lower eyelid.

Sixty-eight patients (79.1%) had bilateral surgery, whereas 18 (20.9%) had unilateral surgery. The majority of patients ($n = 78$, 90.7%) were females, whereas 8 (9.3%) were males. The average age was 38.5 years (range: 20–56 y). Regarding the previous surgical methods, 12 patients (14.0%) performed nonincision method, 29 (33.7%) had partial incision method, and 45 (52.3%) had full-length incision method. In terms of previous eyelid surgeries before referral to our hospital for revision surgery, 58 patients (67.4%) had 1 previous surgery, 18 (20.9%) had 2 previous surgeries, and 10 (11.6%) had 3 or more prior surgeries. The revision surgery was 6 months to 12 years from the last previous operation.

Each patient underwent a comprehensive eyelid examination, including the symmetry and size of existing lid folds, the previous lid crease height, the adequacy of the eyelid skin, the volume of the upper eyelid, the function of levator palpebral superioris, the margin reflex distance 1, and the extent and degree of the scar adhesions.

Obvious asymmetry of bilateral eyelid folds was observed in 38 patients (44.2%) before surgery. Besides high eyelid fold in the 154 eyelids, most eyelids were accompanied by other complications, including deep folds ($n = 78$, 50.1%), depressed scar ($n = 84$, 54.5%), ectropion ($n = 38$, 24.7%), blepharoptosis ($n = 48$, 31.2%), which included mild ptosis in 26 eyelids (16.9%), moderate in 16 eyelids (10.4%), and severe in 6 eyelids (3.9%), multiple folds ($n = 29$, 18.8%), and sunken eyelids ($n = 24$, 15.6%) (as shown in Supplemental Table 1, Supplemental Digital Content 1, <http://links.lww.com/SCS/E508>).

Of the 154 eyelids (86 patients) requiring revision surgery, the preoperative mean lid crease height was 9.8 mm (range: 8.0–13.0 mm). Among them, the height was 8.0 to 9.0 mm in 24 eyelids (15.6%), 9.1 to 10.0 mm in 56 eyelids (36.4%), 10.1 to 11.0 mm in 34 eyelids (22.1%), 11.1 to 12.0 mm in 26 eyelids (16.9%), and 12.1 to 13.0 mm in 14 eyelids (9.0%). The preoperative pretarsal show ranged from 2.5 to 5.0 mm, with an average of 3.5 mm (as shown in Supplemental Table 2, Supplemental Digital Content 1, <http://links.lww.com/SCS/E508>). Informed consent was obtained from all patients, and the study followed the principles in the Declaration of Helsinki.

Surgical Design

Before revision surgery, a new proper height eyelid crease incision line, which is usually located 5.5 to 7.5 mm above the margin of the eyelash, was designed according to each patient's characteristic of periorbital anatomy and personal esthetic preference. If the patient desires a relatively low lid fold, the height of the new incision line is usually designed to be 5.5 to 6.5 mm. For those requiring a relatively high eyelid fold after revision surgery, the incision line is designed to be 6.5 to 7.5 mm. The upper border of the skin incision line depends on the location of the original incision scar and the redundant skin. If there was sufficient skin, we excised the original incision scar; otherwise, we kept part of or the entire scar. For those who cannot remove all the scar tissue, we will inform the patients before the operation that a possibility of a visible scar may remain. Before the operation, digital photos were taken of each patient.

Surgical Technique

All surgical procedures were performed under local anesthesia in a supine position. Each eyelid was injected with about 1.0 mL of 1% lidocaine containing 1:200,000 epinephrine. An incision was made with a no. 15 surgical blade along the marked line. The skin between the lower and upper incision lines was removed by ophthalmic scissors (Fig. 2A). Step by step meticulous dissection was performed to enter into preaponeurotic space. The lower dissection plane began at the lower incision line through orbicularis oculi muscle and proceeded in a cephalic direction under the scar tissue but superficial to pretarsal tissue and levator aponeurosis. The upper dissection plane started at the upper incision line in a superiorly beveled approach between upper orbicularis oculi muscle and scar tissue and continued upward between septum and orbital fat (Fig. 3B).¹⁰ The redundant orbicularis oculi muscle and cicatricial tissue was completely excised, and the pretarsal orbicularis muscle in the lower flap was preserved (Fig. 2B). Submuscular lower flap dissection will be performed in patients with ectropion. The scar adhesions attached to levator aponeurosis was completely lysed (Fig. 2C). Then, the residual orbital fat was fully separated and pulled down to lower incision margin without tension (Figs. 2D, E). If the residual fat was insufficient, orbital fat from bilateral lower eyelid will be harvested via transconjunctival approach for free fat grafting. The volume was determined by the deficiency of the upper lid. Usually, 1.0 to 1.5 mL fat is sufficient for each lid. Attention should be paid not to result in lower lid hollowness. At this time, the patient was asked to sit up and open their eyes in primary gaze to evaluate the levator function. Some ptosis patients may recover normal levator function after adhesion lysis. The remaining blepharoptosis cases were corrected by levator advancement. The fixation was performed first by biting the superficial portion of the tarsal plate at the desired height with a 7-0 nylon suture (Fig. 2F) and followed by securing the lower orbicularis muscle close to the skin margin. Then, the stitch was knotted but did not cut (Fig. 2G). Subsequently, the fixation continued by passing through orbital fat and finished by knotting again (Fig. 2H). Usually, 3 fixation sutures at mid-pupillary, 8 mm medial and lateral this point is adequate to form lid fold. Finally, skin closure was completed with interrupted 8-0 nylon suture in the skin-orbicularis-skin manner to avoid depressed incisional scar formation. A schematic diagram of the formation mechanism of high fold and surgical procedures are shown in Figure 3.

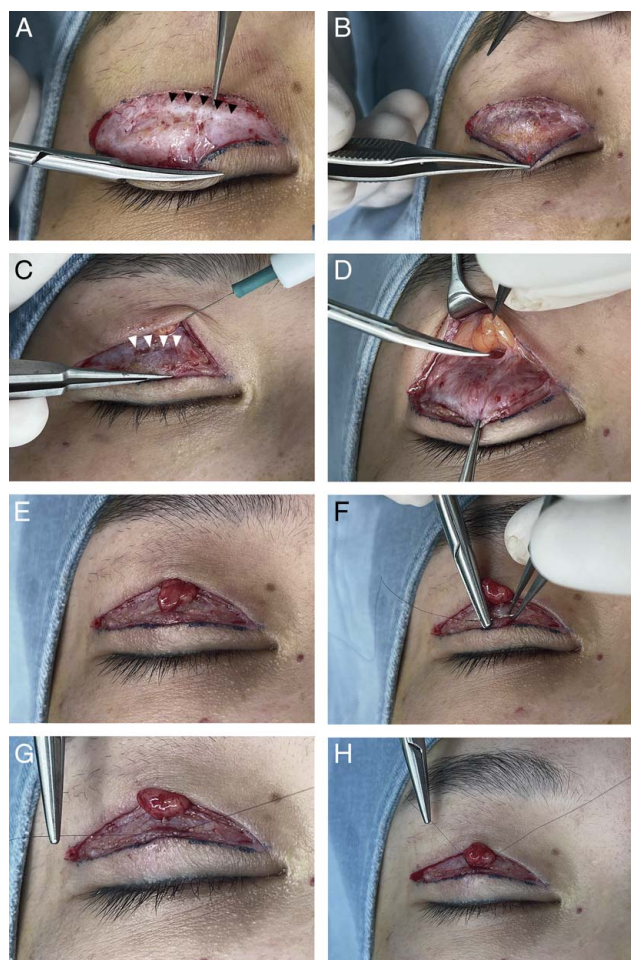


FIGURE 2. Surgical technique. (A) After redundant skin was removed, the scar tissue (black arrowhead) underneath can be clearly seen. (B) The redundant orbicularis oculi muscle and cicatricial tissue were completely removed. The pretarsal orbicularis muscle (red arrow) in the lower flap was preserved. (C) The previous scar adhesions (white arrowhead) that attached to levator aponeurosis were completely lysed. (D, E) The residual orbital fat was fully separated and pulled down to lower incision margin without tension. (F) The fixation was performed first by biting the superficial portion of the tarsal plate at the desired height with a 7-0 nylon suture. (G) The fixation followed by securing the lower orbicularis muscle close to the skin margin. The stitch was knotted but did not cut. (H) Finally, the fixation continued by passing through orbital fat and tied again.

Postoperative Care

The incisions were covered with sterile gauze for 24 hours. Intermittent cold compresses were applied 48 hours postoperation to relieve pain and edema. Suture removal was performed 5 to 7 days after surgery. Each patient is followed for at least 6 months after surgery.

RESULTS

The mean follow-up period was 13 months (range: 6 to 24 mo). There was no complication of lagophthalmos, multiple folds, ectropion, depressed scar, deep folds, or eyelid heaviness in all the patients. No patient occurred fold disappearance during the follow-up period. Three patients (3.5%) reserved the previous incision, the scar was nearly invisible at 6 months postoperative. Six patients (7.0%) underwent free orbital fat grafting from the lower eyelid because of the residual upper orbital fat was insufficient. No complication relevant to free fat grafting was found in these patients.

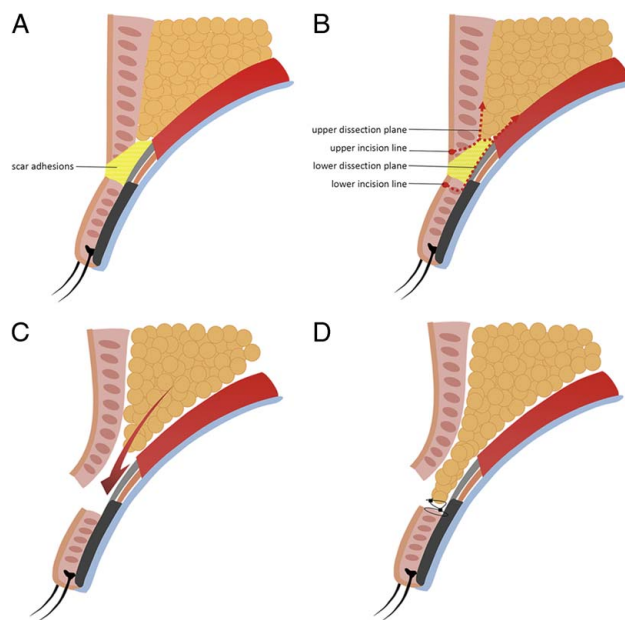


FIGURE 3. Illustrations of the formation mechanism of high lid fold and revision surgical procedure. (A) A schematic diagram showing the formation mechanism of high lid fold. High located scar adhesions (yellow area) lie between skin and aponeurosis after previous surgery. (B) Schematic diagram showing the preoperative incision lines design, and also illustrating the upper and lower dissection plane. The red dotted lines indicate the pathway of dissection. The redundant skin and scar tissue will be removed during revision operation. (C) The residual orbital fat was fully released and pulled down to lower incision margin without tension (the red arrow). (D) The tarsus-orbicularis fixation combined with orbital fat repositioning technique was performed to create double eyelid and reconstruct the gliding zone.

After fully releasing the levator aponeurosis adhesion, 22 mild ptosis eyelids recovered normal levator function, whereas the remaining ptosis patients were corrected by levator advancement. The mean lid crease height was 6.8 mm at 6 months postoperation. The mean pretarsal show was 1.9 mm (range: 1.5–2.1 mm) at 6 months postoperation. Typical cases are presented in Figures 4 and 5.

Postoperative evaluation was administered by both the patients and the surgeons. The evaluation included fold size, fold symmetry, and eyelid ptosis. The esthetic outcomes were graded as follows:

- (1) Fully satisfied: high eyelid folds are successfully lowered to the desired height with natural-looking, both the patients

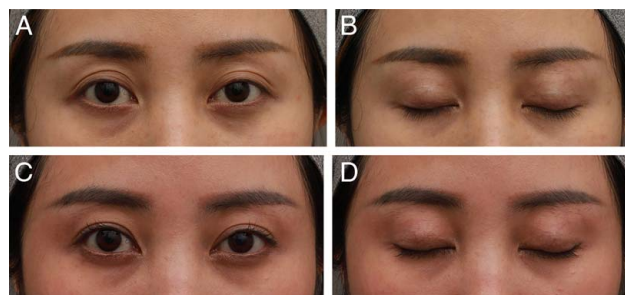


FIGURE 4. (A) A 24-year-old female patient presented with high eyelid folds, asymmetric folds, multiple creases, and sunken eyelid 5 years after previous suture method double eyelid surgery with eyes open and closed (B). (C) Thirteen months after revision surgery, she got a natural and symmetrical double eyelid folds. (D) The scar of her eyelid crease is almost invisible when eye closed.

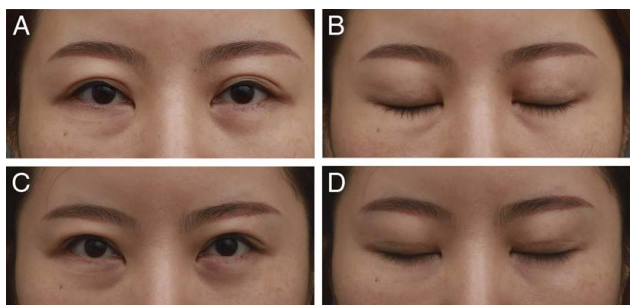


FIGURE 5. (A) A 34-year-old female patient presented with high eyelid folds, asymmetric folds, multiple creases, and depressed scar 7 years after previous incisional double eyelid surgery with eyes open and closed (B). (C) Fifteen months after revision surgery, she got a natural and symmetrical double eyelid folds. (D) The scar of her eyelid crease is almost invisible when eye closed.

and the surgeons are satisfied with the eyelid fold size and shape; bilateral eyelid folds are symmetrical; no eyelid ptosis.

- (2) Basically satisfied: high eyelid folds are successfully lowered with natural-looking, but there is a slight flaw in fold size or shape; there is a slight bilateral asymmetry or slight ptosis but acceptable. The patients are generally satisfied with the outcomes, and there is no need for a revision operation.
- (3) Unsatisfied: The patients are dissatisfied with the fold shape or size, or the patients do not accept bilateral asymmetry or ptosis. Reoperation is demanded.

The esthetic outcome was fully satisfied in 78 patients (90.7%), and basically satisfied in 6 patients (7.0%) including a slight asymmetry of bilateral fold ($n=3$, 3.5%) and a little low fold ($n=2$, 2.3%), and slight ptosis ($n=1$, 1.2%). Two patients (2.3%) were unsatisfied because of ptosis in 1 patient and asymmetry in the other. They both got satisfied results after reoperation. All the participants enrolled in this study achieved successful lowering of fold size and obtained natural-looking upper eyelids after surgery.

DISCUSSION

Although most patients acquired beautiful double eyelid folds after double eyelid blepharoplasty, the number of people who got unsatisfactory outcomes even severe complications was also increasing year by year. Among these unacceptable results, abnormally high lid fold is a common complaint and the main cause of patients requiring revision operation.^{3,6,7,9,11} However, few papers published on Asian eyelid complications of high eyelid folds and their corrections. Successful correction of high eyelid folds among Asians remains one of the most challenging procedures for plastic surgeons.

Abnormally high eyelid fold refers to those with long distance of pretarsal show when eyes were kept in primary gaze, which makes the eyelid unnatural-looking, puffiness (also called “sausage eye”).³ High folds are usually accompanied by deep folds, depressed scar, ectropion, blepharoptosis, multiple folds, asymmetry, sunken eyelids, lower flap tumidness, and eyelid heaviness. These situations affect both appearance and physiological function of the eyes. In addition, it gives rise to a severe psychological burden on the patients.¹² The ideal size and shape of a double eyelid fold vary depending on each patient’s periorbital anatomy and esthetic preferences. Thus, no unified aesthetic standard of double eyelid fold has been reached. Accordingly, there is also a lack of criteria for defining too high

eyelid fold. The preoperative pretarsal show of patients in this study was 2.5 to 5.0 mm (mean 3.5 mm) and the postoperative pretarsal show was 1.5 to 2.1 mm (mean 1.9 mm) ($P<0.001$). In Young’s study, mean pretarsal show decreased significantly from 3.1 mm preoperation to 2.0 mm postoperation.⁸ Therefore, we draw a preliminary conclusion that abnormally high double eyelid fold of Asians might appear when the pretarsal show is >2.5 mm, and the appropriate pretarsal show for Asians is about 2.0 mm. We also observed in our study that when the pretarsal show is >2.5 mm, the larger the distance, the more unnatural the eyelid appears.

As can be seen from Supplemental Table 2, Supplemental Digital Content 1, <http://links.lww.com/SCS/E508>, when the lid crease height is >10 mm, most patients (37/74, 50.0%) appeared with various degrees of ptosis, and nearly all the moderate to severe ptosis eyelids (20/22, 90.9%) have the lid crease height >11 mm. Therefore, we may conclude that the higher the lid crease height, the more prone to ptosis; moreover, the degree of ptosis is more severe. The reason behind this phenomenon is that the high located adhesion will overload the levator muscle and restrict its movement.

Abnormally high eyelid fold can be caused by the following factors.^{3,5-9,13} First, high double eyelid crease incision design and high fixation from the previous operation are the most common causes. Improper fixation that is set too high may lead to eyelash eversion or unesthetic showing of the red tarsal margin. That is why high folds are usually accompanied by ectropion. Thirty-eight eyelids (24.7%) in this study appeared ectropion before revision surgery. The range of lid crease height before our revision surgery was 8.0 to 13.0 mm (mean 9.8 mm), suggesting that the design of double eyelid crease height >8 mm for Asians should be carefully considered. Second, excessive skin was removed during the previous surgery, which resulted in insufficient upper eyelid skin to cover the pretarsal tissue. Third, too much orbicularis oculi muscle and orbital fat were excised, which lead to unintended high adhesion. In addition, sunken eyes are more prone to result in high adhesion and thus high fold occurs. In the last, if the patients had underlying or borderline eyelid ptosis before surgery, the levator muscle function was not rectified during surgery. Such cases are more likely to appear high eyelid fold with blepharoptosis because the newly created eyelid fold burdens the levator.⁷ Similarly, unrecognized levator aponeurosis injury during the surgery can also lead to high fold with ptosis.⁵

Before performing a revision blepharoplasty, the surgeon should have a comprehensive evaluation of the current problems and figure out the etiologies of these deformities.^{3-9,11,13-15} The basic strategies for a successful correction of high eyelid fold include lowering the lid crease height to a proper position, releasing adhesion, reconstructing the gliding zone, and avoiding unwanted adhesion. For patients with upper eyelid volume deficiency or/and ptosis, volume augmentation or/and ptosis correction should be performed at the same time.

In this retrospective study, the newly designed lid crease height was 5.5 to 7.5 mm, which was much lower than the previous height (range of 8.0–13.0 mm), and the mean lid crease height decreased from 9.8 mm preoperation to 6.8 mm postoperation ($P<0.001$). During the revision operation, the redundant skin and cicatricial tissue were excised. If the skin was insufficient, we did not remove any skin and the original skin incision was retained. Under the circumstances, we will inform the patients before the operation that a possibility of a visible scar may remain. Although 3 patients reserved the previous incision, the scar was nearly invisible 6 months after surgery. The adhesion between skin and levator aponeurosis was completely released, and the

residual orbital fat was fully separated. If the residual fat was insufficient, orbital fat from the lower eyelid will be harvested for free fat grafting. Six patients performed free orbital fat grafting from the lower lid to augment the volume of the upper eyelid. The results proved to be satisfactory during 6 months follow-up, and no complication was observed in these cases. In our opinion, free orbital fat grafting from the lower eyelid is a great option for those with insufficient residual orbital fat in the upper eyelid.¹⁶

For patients with blepharoptosis, 22 mild ptosis patients recovered normal levator function after completely releasing the adhesion. The remaining 26 ptosis patients recovered normal levator function through levator advancement. Among the 6 patients with severe blepharoptosis, 2 patients still had slight ptosis after surgery. One patient was basically satisfied with the results and did not intend to have further corrective surgery. The other patient acquired reoperation and got a satisfied result. Wattanakrai et al⁶ described a novel technique of correction of high fold in which levator advancement was performed in all 213 of the secondary blepharoplasty patients. He deemed that levator advancement was a key point in secondary surgery. However, according to our study, we found that it is not necessary to perform levator advancement in all the secondary blepharoplasty patients even those with prior ptosis. Some patients appeared blepharoptosis because of levator muscle movement restricted by aponeurosis adhesion, and these cases would recover normal levator function after fully releasing the previous adhesion. This opinion is in agreement with Huang et al¹⁷ and Guo et al's study.⁵

The fixation was performed first by biting the superficial portion of the tarsal plate at the desired height with a 7-0 nylon suture and followed by securing the lower orbicularis muscle close to the skin margin. Then, the stitch was knotted but did not cut. This maneuver helped to form a steady lid fold and keep the pretarsal skin-muscle flap tightly stretched, which minimized the risk of a bulky pretarsal lip caused by the retraction of the remaining orbicularis muscle.¹⁸ Subsequently, the fixation continued by passing through orbital fat and finished by knotting again. Fixing with orbital fat can reconstruct the gliding zone and avoid unexpected readhesion.¹⁹ This approach combining tarsus-orbicularis fixation with orbital fat repositioning together has the following advantages.

- (1) This fixation technique helps to form a steady double eyelid fold and prevents the fold from becoming shallow or disappearance. In addition, it reserved the pretarsal orbicularis muscle that can minimize damage and avoid depressed scar formation.
- (2) It can reconstruct the gliding zone in the upper eyelid, which helps to prevent unintended readhesion and avoid the formation of multiple folds.¹⁰
- (3) It can get rid of restriction to levator aponeurosis caused by the readhesion of scar tissue after revision surgery. Therefore, the patient often feels easier to open their eyes after operation.
- (4) This fixation method avoids skin directly attached to levator aponeurosis, which can effectively correct and prevent deep folds, and avoid the forming of depressed scar and upper eyelid ectropion.
- (5) This method can correct mild to moderate sunken eyelid because the orbital fat was firmly fixed to the upper border of the lid crease line. This maneuver can prevent fat from retracting with eye movement.

Patients seeking revision blepharoplasty usually experienced many operations and suffered great psychological burdens. Before revision surgery, we should have adequate communication with the patient and insight into the patient's desire. In addition, the patient should be informed of the predictable postoperative

outcome of what can and cannot be resolved. The recovery time after the revision operation was longer than primary blepharoplasty and the patient needed to wait patiently because the eyelid fold may remain high during the early swelling period. Surgeons should have a thorough understanding of eyelid anatomy and the mechanism of double eyelid formation together with familiarity with secondary blepharoplasty to avoid further complications.

In conclusion, the tarsus-orbicularis fixation combined with orbital fat repositioning technique is a simple and effective method to correct high eyelid fold with high satisfaction and rare complications. The key points for successful revision surgery are lowering the lid crease height, fully releasing the prior adhesion, reconstructing the gliding zone, and avoiding unwanted adhesion. By combining orbital fat repositioning, this fixation technique can ideally fulfill the latter 2 key elements.

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