

Corrective Strategies for a Complex Deformity Caused by “European-Style Double Eyelid” Blepharoplasty in Asians

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Abstract

Background “European-style double eyelid” blepharoplasty often leads to a complex deformity, which includes one or more of the following features: a high fold, upper eyelid depression, multiple folds, an obvious scar, blepharoptosis, and lower flap tumidness. However, there is still a lack of comprehensive research on evaluation and treatment strategies for this complex deformity.

Methods During a 6-year period, 65 patients (106 eyes) with a high fold and upper eyelid depression underwent corrective blepharoplasty. The authors classified this complex deformity as mild, moderate, or severe based on the extent of adhesion and tissue insufficiency, and we performed preaponeurotic fat flap transfer in 47 eyes (44.3%), free fat graft in 35 eyes (33%), and free dermis-fat graft in 24 eyes (22.6%), respectively.

Results The outcomes in 87 eyelids were judged as excellent; and the grading was excellent in 41 eyes (87.2%) that underwent preaponeurotic fat flap transfer, 30 eyes (85.7%) that received a free fat graft, and 16 eyes (66.7%) that received a free dermis-fat graft. The outcomes in only 3 eyes (2.8%) were evaluated as unsatisfactory.

Conclusions The fundamental reasons behind this deformity were adhesion and tissue insufficiency above the supratarsal crease. The purpose of correction was to reconstruct the gliding system and restore the volume. The authors performed preaponeurotic fat flap transfer, free fat graft, and free dermis-fat graft and achieved satisfactory results. Great improvement in ptosis was achieved by releasing the adhesion and lowering the fold in patients with normal levator muscle function.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Secondary blepharoplasty · Correction of the high fold · Preaponeurotic fat flap transfer · Free dermis-fat graft · Free fat graft

Introduction

Blepharoplasty is the most popular cosmetic surgery in Asia. There are many surgical methods and different outcome patterns. The patients’ orbital conditions and aesthetic preferences play an important role in the application of this procedure.

Since the nineteenth century, the influence of the Western culture on Eastern countries has gradually been increasing and it has altered the cosmetic standard [1]. The ancient Chinese preferred single-folded eyelids and almond-shaped eyes, but double eyelids that give a Western look have become the symbol of beauty nowadays. Mikamo [1] performed the first Asian blepharoplasty and increased the popularity of blepharoplasty among Asians.

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The main characteristics of European upper eyelids are a high fold and a depressed eyelid compared to Asian upper eyelids, which are caused by anatomical features, such as high tarsus and lack of fat. The location of the inferior border of the orbital septum is 5–10 mm above the superior tarsal border [2], but it is located below the superior tarsal border in Asians (Fig. 1).

For Asians, experienced doctors prefer the natural style of a double eyelid. Generally, experienced doctors place the skin incision over the levator aponeurosis or the superficial structure before the tarsal plate and excise the prolapsed orbital septum and preaponeurotic fat beneath the desired crease.

“European-style double eyelid” is a proper noun in China describing the upper eyelid with a higher and deeper fold than natural which looks Caucasian. However, once the surgeon excises the orbital septum, preaponeurotic fat, and even orbicularis oculi muscle beyond the tarsus to achieve a high supratarsal crease and deep-set eyes like Europeans, the skin and the levator muscle will adhere at a high position and result in a complex deformity, which includes one or more of the following features: a high fold, upper eyelid depression, multiple folds, an obvious scar, blepharoptosis, and lower flap tumidness (Figs. 2, 3AB). We defined that as a complex deformity caused by “European-style double eyelid” blepharoplasty.

This complex deformity is one of the most complex complications after blepharoplasty, and it is a huge challenge for plastic surgeons. The purposes of the correction are to lower the high fold and to restore the volume. The basic procedure consists of the following steps: releasing

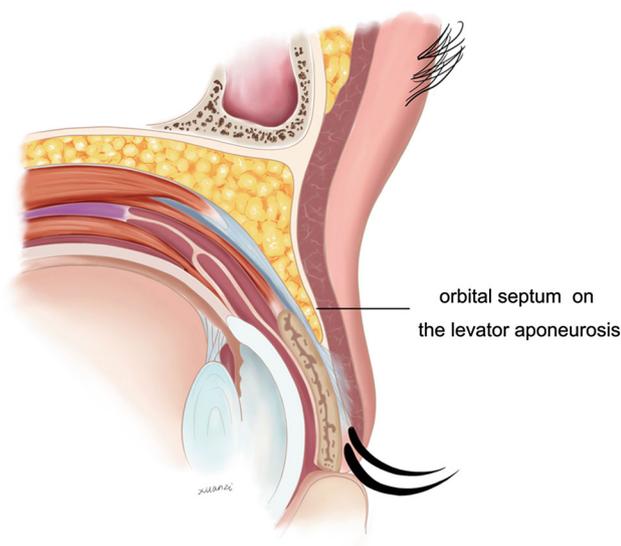


Fig. 1 An illustration of an Asian upper eyelid; note part of the orbital septum is in front of the tarsal plate

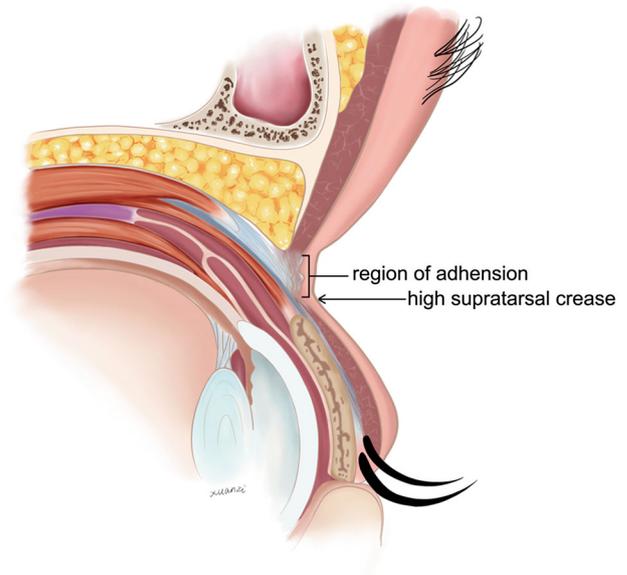


Fig. 2 An illustration of the complex deformity; note the adhesion and tissue insufficiency lead to a high fold and upper eyelid depression

adhesions, tissue transfer to restore the volume and prevent re-adhesion, and creation of a new crease.

The key point is tissue transfer. The tissues used in previous studies include prosthesis, preaponeurotic fat, a pretarsal fibromuscular flap, free fat graft, dermis-fat graft, and fascia-fat graft [4–12]. Because prostheses lead to higher rates of infection, rejection, and an obvious contour of the prosthesis, they are not commonly used. Preaponeurotic fat flap transfer is an effective method for the eyes with preaponeurotic fat remaining. A pretarsal fibromuscular flap is transferred from the lower flap to the upper side, and the application is limited due to the absence of the orbicularis oculi muscle. A fat granule can be injected to treat the upper eyelid depression, but it's unable to improve the adhesion during the secondary blepharoplasty. Free fat grafts, free dermis-fat grafts, and free fascia-fat grafts are reliable techniques, and it's been reported that the latter two methods get a higher survival rate.

However, most of the reports have focused on one technique and have ignored the integration of the deformities. There is a lack of systematic research about grades of severity and criteria for the selection of surgical methods.

In this study, we introduced exhaustive features and evaluation of the complex deformity, classified the deformity as mild, moderate, or severe based on the extent of adhesion and tissue insufficiency, performed corresponding surgery for different grades, and evaluated the outcomes.

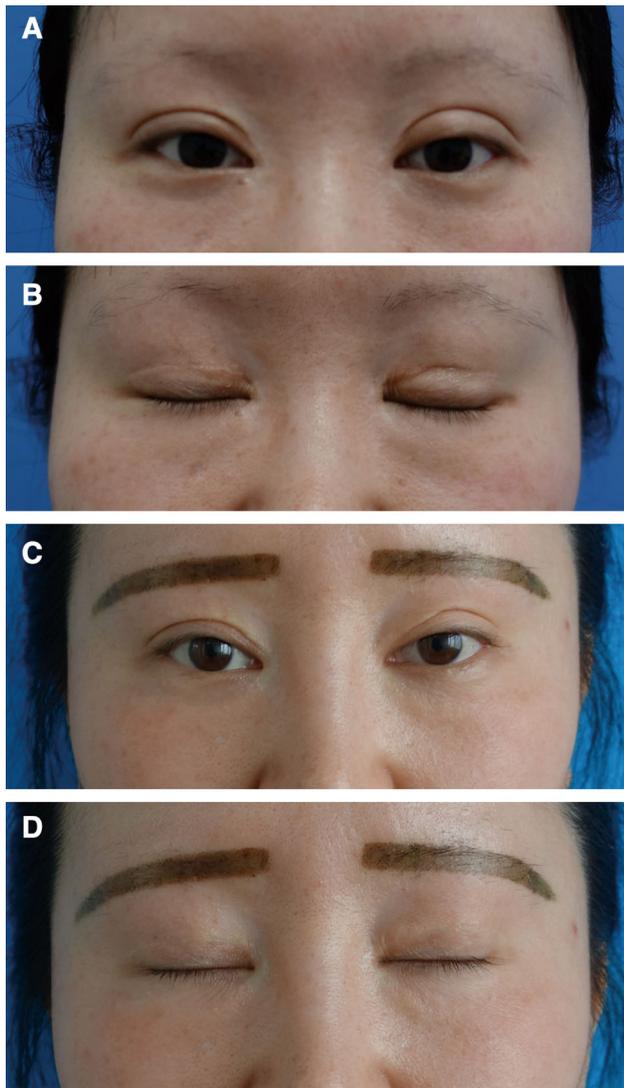


Fig. 3 A 32-year-old woman presented for the complex deformity and the outcome of secondary blepharoplasty with a free dermis-fat graft. **a** Preoperative view showed the patient had the complex deformity, including a high fold, upper eyelid depression, mild ptosis, and lower flap tumidness. **b** Preoperative view showed an obvious scar and adhesion above the supratarsal crease. (CD) The patient is shown at her 24-month follow-up. Note correction of upper eyelid depression, ptosis, lower flap tumidness, and the scar. The lateral high fold of the left eye was not lowered, and the result of the right eye was satisfactory

Materials and Methods

Between November 2011 and November 2017, 65 patients (106 eyelids) with deformities, such as a high fold and upper eyelid depression, underwent corrective blepharoplasty and continuous follow-up for more than 6 months. The patients gave informed consent, and the study was conducted in accordance with the principles of the Helsinki Declaration. All of the patients were Asian females with a mean age of 26 years (range, 18–45 years). Corrective

blepharoplasties in all of these patients were performed by the senior author; all primary blepharoplasties were performed by other surgeons.

Preoperative Evaluation

Preoperative evaluation was comprehensive. First of all, an overall assessment was performed. Doctors were aware of the previous surgical procedure and the patient's expectation.

Local evaluation of the periorbital region was performed the very next moment, and it included the present deformity and the personal condition independent of primary blepharoplasty. The present deformity included one or more features, such as a high fold, upper eyelid depression, multiple folds, an obvious scar, blepharoptosis, and lower flap tumidness. In our opinion, the fundamental reasons behind this complex deformity were adhesion and tissue insufficiency above the supratarsal crease; therefore, a high fold and upper eyelid depression were the key features of the deformity, and emphasis was placed on the evaluation.

The skin between the high fold and the newly created natural fold was removed under ideal conditions to prevent formation of a triple fold. Attention was paid to distinguish the position of the initial crease and the crease caused by adhesion beyond the tarsus. The region between the two creases showed the location of the adhesion.

The location and extent of the depression were noted. Because there is more fat and thicker skin on the lateral part, the medial eyelid is more prone to depression. The evaluation of the volume and the distribution of residual preaponeurotic fat were the factors that determined the possible corrective method. The extent of adhesion and tissues insufficiency was clearly determined, and the classification was based on these two factors.

It was noted whether the eyelid crease was too deep, and a deep crease indicated that there was little tissue remaining before the tarsus. We also focused on the location and width of the scar. A scar commonly developed at the site of the incision, and it could be removed during the corrective procedure if there was sufficient skin. At the same time, the skin above the supratarsal crease was likely to be uneven as a scar due to a tight adhesion between skin and levator aponeurosis, and the uneven skin indicated the extent of adhesion.

Lower flap tumidness is commonly described as a “cutlet-like eyelid.” Because the orbicularis oculi muscle is thick in Asians, the lower flap may appear swollen if too much tissue is removed from the upper flap and too much tissue is preserved in the lower flap. Lower flap tumidness can also be observed if the inferior skin incision is higher than the fixation position on the tarsus. Finally, it was noted whether there was a sufficient amount of skin.

Blepharoptosis was easy to detect, but an evaluation of levator muscle function was difficult. The most common reasons for blepharoptosis following blepharoplasty included injury to the levator aponeurosis and adhesion between the skin and the levator aponeurosis; therefore, evaluation could not be performed until releasing the adhesion.

It was also necessary to evaluate the personal condition independent of primary blepharoplasty. We focused on the size and shape of the eye, the distance between the eye and the eyebrow, the height of the brow arch, the epicanthal fold, congenital blepharoptosis, proptosis, previous ophthalmic surgery, and chronic eyelid disorders. The patient's preoperative photograph was obtained, and it was compared with the current state, if possible. We especially paid attention to whether there was blepharoptosis or upper eyelid depression before primary surgery. This helped to determine the reason for the current deformities and the suitable corrective method.

According to the extent of adhesion and tissue insufficiency, we classified this complex deformity into the following three grades (Table 1):

I Mild A high fold and upper eyelid depression at the medial side only; possible multiple folds; an obvious scar above the crease, blepharoptosis, and lower flap tumidness are seldom observed. The adhesion is present at the medial eyelid, and lateral preaponeurotic fat is present. The purpose of repair is to reconstruct the gliding system, so preaponeurotic fat flap transfer is the best method.

II Moderate An overall high fold; upper eyelid depression; an obvious scar caused by adhesion between the skin and levator aponeurosis above the crease is seldom observed. The adhesion above the crease is at the whole length, while orbicularis oculi muscle is still present. The purpose of repair is to reconstruct the gliding system, and free fat graft is an ideal method.

III Severe An overall high fold; upper eyelid depression; an obvious scar above the crease; other features

(multiple folds, blepharoptosis, and lower flap tumidness) are often observed. Because of the absence of the aponeurotic fat and orbicularis oculi muscle, the purpose of repair is to reconstruct the gliding system and restore volume. A free dermis-fat/fascia-fat graft with a higher survival rate was the preferred option. We performed free dermis-fat grafts in this study.

The surgical methods described above were not the only choices, but they were some of the most minimally invasive and easiest methods.

Some patients with sunken eyes before primary surgery may develop complex deformities if the doctors perform unnecessary dissection over the supratarsal crease. The features, evaluations, and corrective strategies were identical.

Sometimes the evaluation was not accurate before surgery, and upper eyelid depression and adhesion were accurately evaluated after releasing the adhesion during the operation. The final surgical plan was determined at this time point.

The intervening period between the previous blepharoplasty and the scheduled secondary blepharoplasty was more than 6 months.

All of the 65 patients (106 eyelids) suffered from a high fold and upper eyelid depression, and some of them had one or more features. Further, 47 eyes (44.3%) with mild deformity underwent preaponeurotic fat flap transfer, 35 eyes (33%) with moderate deformity underwent free fat graft, and 24 eyes (22.6%) with severe deformity underwent free dermis-fat graft.

Techniques

The patient was placed in a horizontal position, and the incision was made after disinfection. The inferior incision was made first, and it was in the position and the shape of the crease. The distance between the inferior incision and the lid margin was 6.5–7.5 mm, and in most of the eyelids,

Table 1 Classification of the complex deformity

	Features			Absent tissues		Purpose of the repair	Technique of the repair
	A high fold	Upper eyelid depression	Scar above the crease	Preaponeurotic fat	Orbicularis oculi muscle above the crease		
Mild	Medial	Medial	No	Medial	No	Reconstruct the gliding system	Preaponeurotic fat transfer
Moderate	Yes	Yes	No	Yes	No	Reconstruct the gliding system	Free fat graft
Severe	Yes	Yes	Yes	Yes	Yes	Reconstruct the gliding system; restore the volume	Free dermis-fat graft

this value was 7 mm (Fig. 4). Next, the superior incision was made and it was dependent on the location of the original incision scar and the redundant skin. If there was sufficient redundant skin, we excised the original incision scar; otherwise we kept part or all of the scar [9].

Local anesthesia was performed utilizing 2% lidocaine with 1:100,000 epinephrine. Due to a tight adhesion, the injection of anesthetics was performed at a slow speed and shallow layer to avoid pain and temporary iatrogenic ptosis. In case of emergency, to ensure that the outcomes were satisfactory, the operation wouldn't be completed until the recovery of the levator function. The adhesion was carefully released after the skin was incised along the incision. We wouldn't excise the remaining tissues until we were sure that they were redundant. Attention was paid to avoid injury to the levator aponeurosis. It was important to preserve the superficial tissues of the tarsal plate, on which the transferred tissues and skin were fixed. The lower flap was dissected and the inferior orbicularis muscle was excised if lower flap tumidness was observed. The levator aponeurosis and the tarsal plate were exposed after the scar was released (Fig. 5).

At this time point, we evaluated the amount of residual preaponeurotic fat and the function of the levator muscle. Grading and corrective method were finally determined.

For a mild deformity [4, 5], preaponeurotic fat flap transfer was performed by releasing the residual preaponeurotic fat from the lateral side and redistributing it to cover the adhesion site above the new supratarsal fold (Fig. 6).

For a moderate deformity [12], a free fat graft harvested from the other upper eyelid or the lower eyelid was performed by distributing it evenly to cover the adhesion site above the new supratarsal fold.

For a severe deformity [14], a free dermis-fat graft was performed (Fig. 7). We harvested the dermal fat from the inner side of the upper arm, which was disinfected before surgery. The size of the arm incision was about 20% more than the area of the adhesion site [14]. The dermis-fat graft with 5–10 mm of underlying fat was obtained after incising



Fig. 4 The incision of a secondary blepharoplasty. The patient received correction of the epicanthus at the same time, and the scar was excised



Fig. 5 The levator aponeurosis and the tarsal plate were exposed after the scar was released. The function of the levator muscle and the remaining fat were evaluated

the skin, removing the epithelium, and cutting out the large fat particles. The thickness of the underlying fat changed according to the severity. The incision over the upper arm was closed, and the free dermal fat was placed at the adhesion site above the new supratarsal fold with the dermis facing anteriorly (Fig. 8).

The sutures were passed through the superior border of the graft and the residual orbital septum beyond the adhesion site, and the inferior edge of the flap was sutured through the superficial tissues of the tarsal plate near the new supratarsal fold with 7-0 nylon (Fig. 9). Suturing of the superior border of the preaponeurotic fat flap was not necessary.

The height of the new supratarsal crease was dependent on the position of fixation of the superficial tissues. The new crease was higher than the inferior skin incision and lower than the superior border of the tarsal plate. The sutures were passed via the inferior skin incision through the superficial tissues and back via the superior skin incision to form the supratarsal crease. The position of the sutures was adjusted until the crease was natural and smooth. The sutures were removed on the fifth day after surgery.

Many patients had one eyelid with a complex deformity, while the other eyelid was normal. In such cases, the question arose as to whether we should perform secondary blepharoplasty on the normal eyelid. This decision was made based on the width of the excised skin and the degree of satisfaction with the normal eyelid. If the width was more than 1 mm or the shape of the normal eyelid was not satisfactory, we suggested the patient undergo correction of both eyelids to avoid postoperative asymmetry.

Fig. 6 The intraoperative images of preaponeurotic fat flap transfer. **a** The preaponeurotic fat was released. **b** The preaponeurotic fat was transferred to cover the adhesion site above the new supratarsal crease

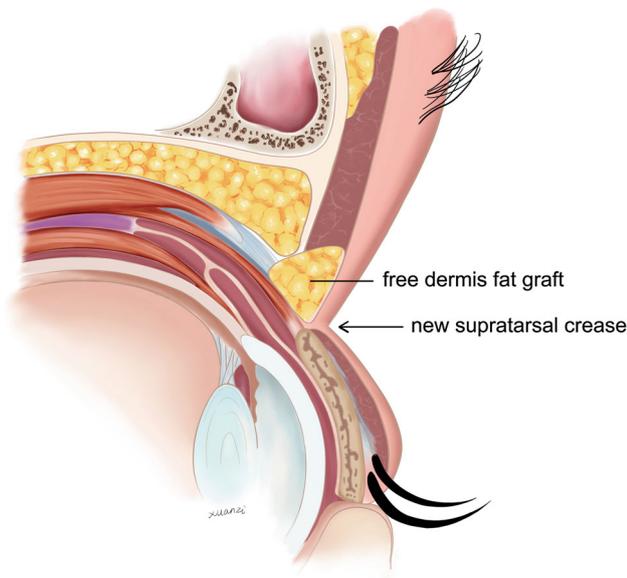
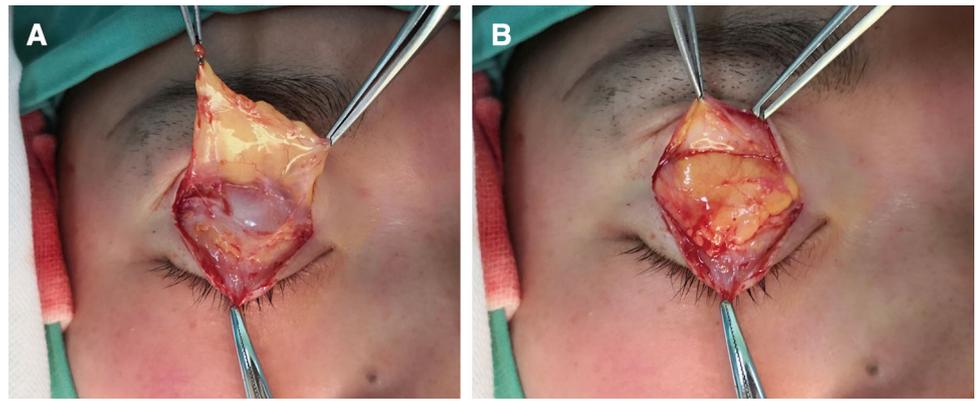


Fig. 7 An illustration of free dermis-fat graft. Free dermal fat was placed before the adhesion site above the new supratarsal fold with the dermis facing anteriorly



Fig. 9 The intraoperative figure of free fat graft. The fat has covered the adhesion site above the new supratarsal fold, and the sutures were finished



Fig. 8 The dermis-fat graft before transferring

Results

Sixty-five patients (106 eyelids) underwent continuous follow-up for more than 6 months. The mean follow-up time period was 12 months (range, 6–48 months). The outcomes were judged as satisfied or not by the patient herself and the other doctors except the first and corresponding authors with the blind method.

Excellent was defined when both doctor and patient were satisfied. Fair was defined when either doctor or patient was satisfied. Poor was defined when neither doctor nor patient was satisfied. The results included excellent in 87 eyelids (82.1%), fair in 16 eyelids (15.1%), and poor in 3 eyelids (2.8%) (Table 2; Figs. 10, 11).

Table 2 Results

	Preaponeurotic fat flap transfer (%)	Free fat graft (%)	Free dermis-fat graft (%)	Total
Excellent	41 (87.2)	30 (85.7)	16 (66.7)	87 (82.1)
Fair	6 (12.8)	4 (11.4)	6 (25)	16 (15.1)
Poor	0 (0)	1 (2.9)	2 (8.3)	3 (2.8)
Total	47	35	24	106

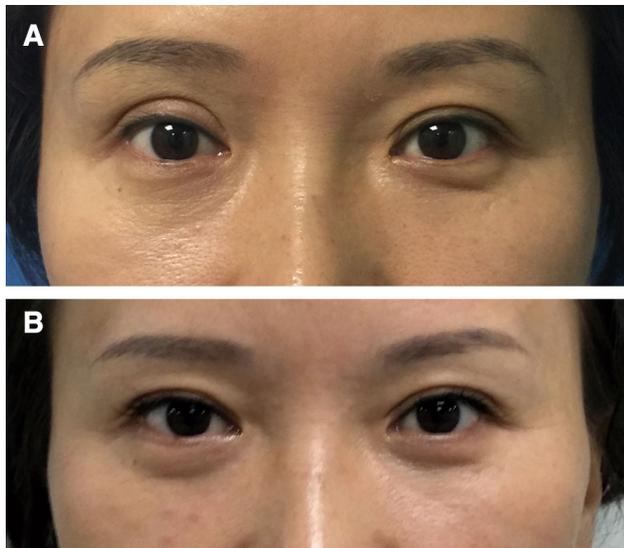


Fig. 10 A 30-year-old woman underwent a secondary blepharoplasty for both eyes and free fat graft for the right eye. **a** Preoperative view showed a high fold and mild upper eyelid depression of the right eye. **b** The patient is shown at her 18-month follow-up, and the result is satisfactory

A poor outcome after a free fat graft was obtained in only one patient who underwent levator advancement at an early stage, and postoperative overcorrection occurred. The outcomes in the other two eyelids that received a free dermis-fat graft were judged as poor because part of the high fold was not lowered.

The concordance among preoperative evaluation with their ultimate grade was 87.7% (93 eyes). Ten eyes preoperatively evaluated as mild underwent free fat grafts finally, and 3 eyes evaluated as moderate underwent preaponeurotic fat flap transfers, because it was difficult to distinguish whether there was fat under the lateral skin sometimes. However, the evaluation for severe was accurate.

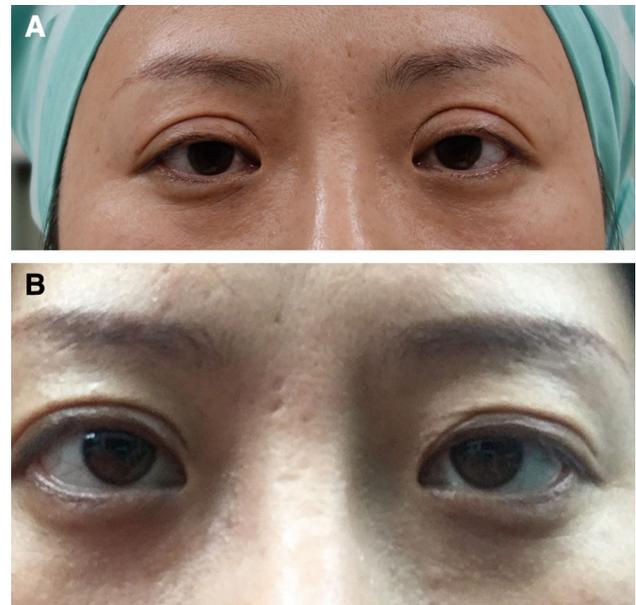


Fig. 11 A 37-year-old woman with the complex deformity received a free dermis-fat graft. **a** Preoperative view showed the patient had the complex deformity, including a high fold, upper eyelid depression, mild ptosis, and lower flap tumidness. **b** The patient is shown at her 6-month follow-up, and the result was satisfactory

Discussion

“European-style double eyelid” blepharoplasty is an incongruous procedure, and an experienced doctor will not perform this surgery. However, because of an explosion in the Chinese population that uses cosmetic products and the chaotic cosmetic market, some untrained “doctors” participate in the cosmetic business and perform incongruous blepharoplasty, which causes a complex deformity. On the other hand, some patients with sunken eyes before primary surgery may develop complex deformities if the doctors perform unnecessary dissection over the supratarsal crease.

Correction of this complex deformity is one of the biggest challenges. The key point is to decrease the fold and avoid re-adhesion above the desired fold. We used to perform secondary blepharoplasty without tissue transfer, and recurrence of adhesions and undesired high folds occurred. Chen [3] described a new concept of a “glide zone,” which consists of the preaponeurotic fat. The

absence of the “glide zone” causes adhesion between the skin and the levator aponeurosis. So, reconstruction of the gliding system is important in secondary blepharoplasty, not only to restore the volume, but also to avoid re-adhesion.

This complex deformity shows one or more features and differs from one another, and doctors may become confused and have no idea about how to perform the repair.

The main reasons behind the complex deformities are a high-fold design and removal of excessive tissue beyond the crease. The main features are a high fold and upper eyelid depression. The pathological characteristics are large area adhesion and tissue insufficiency above the crease. Therefore, the classification and corrective strategy depend on the extent of the adhesion and tissue insufficiency. However, adhesion is also a result of tissue insufficiency; therefore, tissue transfer is the core step in secondary blepharoplasty. In fact, the features, such as multiple folds, an obvious scar, blepharoptosis, and lower flap tumidness, are mainly caused by adhesion and tissue insufficiency, so the features will be improved after tissue transfer.

Deformities, including an obvious scar, blepharoptosis, multiple folds, and lower flap tumidness, were improved satisfactorily except for the overcorrected blepharoptosis (Fig. 12). In the early stage, we performed levator advancement for the patient who did not have ptosis before the primary operation. The intraoperative outcome was excellent after the release of the adhesion. To ensure absence of recurrence, we performed levator advancement for the patient and overcorrection occurred. Since then, we do not perform levator advancement during secondary blepharoplasty if the function of the levator aponeurosis is normal, and the improvement in ptosis is satisfactory.

Blepharoptosis is a complication accompanied by a high fold. The common reasons include levator aponeurosis dehiscence and adhesion between the skin and the levator aponeurosis at a high position. Simultaneous correction of blepharoptosis and a high fold is controversial. Wattanakrai [15] reported a novel technique in which levator advancement and secondary blepharoplasty were performed at the same time, and the author performed levator advancement in all 213 of the patients. However, Kim [9] created a spring model similar to the levator aponeurosis, and the physics calculation revealed that a high fold increased the weight load on the levator muscle, which indicated that lowering the fold can improve the blepharoptosis. Wolfort [16] had a similar idea as Kim. In our opinion, ptosis caused by excessive supratarsal fixation can be corrected after releasing the adhesion and lowering the fold. Considering the good outcome after releasing the adhesion and numerous complications after advancement of the levator muscles, it is not necessary to advance the

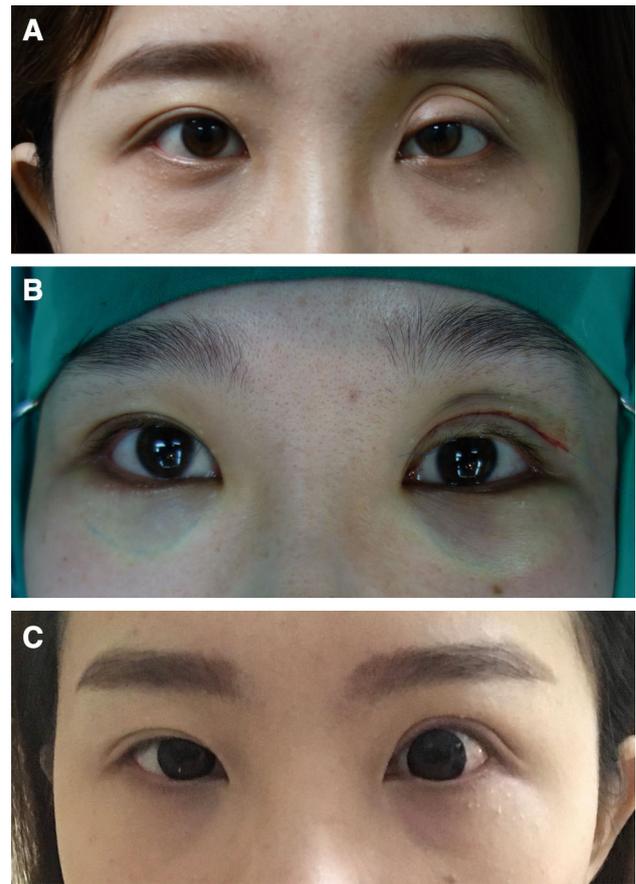


Fig. 12 A 26-year-old woman underwent a free fat graft to the left eye who had received blepharoplasty three times before. **a** Preoperative view showed the patient had the complex deformity, including a high fold, upper eyelid depression, ptosis, multiple folds, and lower flap tumidness. **b** The intraoperative outcome was excellent after release of the adhesion. **c** We performed levator advancement for the patient and overcorrection occurred. The patient is shown at her 12-month follow-up. Note the correction of the high fold, upper eyelid depression, multiple folds, and lower flap tumidness, and the overcorrection occurred

aponeurosis during complex secondary blepharoplasty, unless the doctors confirm that there is a lack of levator muscle function.

The survival rate of dermis fat is higher than that of fat, and thus, a similar survival rate can be achieved as that after vascularized tissue transfer [12–14, 17]. Lee [7] believes that a dermis-fat graft is heavier than a fascia-fat graft, and therefore, a dermis-fat graft is prone to blepharoptosis. However, we did not observe a tendency toward ptosis. The comparison of dermis fat and fascia fat is a topic that needs further research [17, 18].

The complications increase with an increase in the severity of deformity and difficulty of surgery. In this study, two eyelids that received a dermis-fat graft showed poor outcomes as part of the high fold that was not lowered

(Fig. 3). The possible reason was that the flap was small and there was a shift, atrophy, and necrosis. However, further research is needed.

In general, doctors perform primary blepharoplasties much more than secondary ones, so it's more important to know about the method to prevent the complex deformities. It includes: 1, do not pursue a high fold excessively; 2, remove proper amount of fat, especially at the medial side; 3, design a lower crease and do not remove fat, if upper eyelid depression is present before surgery, and fat graft is performed if necessary; 4, orbicularis oculi muscle above the incision shouldn't be excised; 5, reserve adequate tissue before the tarsal plate to avoid incision depressed scar.

In this research, we studied the relationship among several deformities and confirmed the fundamental reasons (adhesion and tissue insufficiency) behind this complex deformity. We identified the key point of evaluation and confirmed the grading system that can help doctors choose the proper method.

Conclusions

In conclusion, the complex deformity caused by “European-style double eyelid” blepharoplasty includes a high fold, upper eyelid depression, multiple folds, an obvious scar, blepharoptosis, and lower flap tumidness. The fundamental reasons are adhesion and tissue insufficiency above the supratarsal crease. The purpose of correction was to reconstruct the gliding system and restore volume. The authors classified this complex deformity as mild, moderate, or severe based on the extent of adhesion and tissue insufficiency, and we performed preaponeurotic fat flap transfers, free fat grafts, and free dermis-fat grafts, and achieved satisfactory outcomes. Great improvement in ptosis was achieved by releasing the adhesion and lowering the fold in patients with normal levator muscle function, and levator aponeurosis advancement was not necessary for these patients.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of

the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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