



# A practical technique combining orbicularis oculi muscle resection-based epicanthoplasty and orbicularis-tarsus fixation double-eyelid plasty for cosmetic blepharoplasty

Weiyi Sun, Ningbei Yin, Tao Song, Di Wu, Haidong Li, Yongqian Wang\*

Plastic Surgery Hospital, Academy of Medical Sciences and Peking Union Medical College, No. 33 of Badachu Road, Shijingshan District, Beijing, China

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## KEYWORDS

Double-eyelid plasty;  
Epicanthoplasty;  
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fixation;  
Muscle resection

**Summary** *Background:* A plump single eyelid with medial epicanthal fold is the morphological feature of the East Asian population. This study describes a practical technique that combines orbicularis oculi muscle resection-based epicanthoplasty and orbicularis-tarsus fixation double-eyelid plasty for cosmetic blepharoplasty and reports on surgical outcomes in a large number of Chinese patients.

*Methods:* For supratarsal crease formation, the soft tissue was removed in a conservative manner and the orbicularis oculi muscle was anchored on the tarsus to build a reliable attachment. To correct the epicanthal fold, a modified redraping technique was used for the design of skin incision, and most importantly, a triangular muscle block composed of the orbicularis oculi muscle was selectively removed to release the abnormal tension in the epicanthal fold.

*Results:* From January 2015 to February 2019, 475 patients underwent double-eyelid blepharoplasty combined with epicanthoplasty using this technique. The follow-up period ranged from 2 to 38 months, with a mean period of 16 months. Of these, 97% of the patients were satisfied with surgical outcomes, presenting well-defined palpebral folds and naturally improved inner canthus contour, with no conspicuous scar. The photographic analysis in 84 patients showed significant improvement in palpebral fissure proportion postoperatively. No supratarsal crease drooping or recurrence of the epicanthal fold was observed up to 38 months after the surgery.

\* Corresponding author.

E-mail addresses: [muqingswy@163.com](mailto:muqingswy@163.com) (W. Sun), [yin\\_nb@126.com](mailto:yin_nb@126.com) (N. Yin), [gxstst@126.com](mailto:gxstst@126.com) (T. Song), [wuudii@126.com](mailto:wuudii@126.com) (D. Wu), [zhengxing66@yeah.net](mailto:zhengxing66@yeah.net) (H. Li), [surgeonfrank@163.com](mailto:surgeonfrank@163.com) (Y. Wang).

**Conclusions:** This method is a safe and reliable technique to achieve an elongated and more balanced eye shape in Chinese patients, with minimal scarring and a low risk of postoperative complication in a long follow-up period.

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## Introduction

Double-eyelid blepharoplasty has been the most popular esthetic procedure for years in East Asia. However, the presence of epicanthal folds may affect the formation of supratarsal folds and weaken the esthetic results of the double-eyelid plasty.

In some conditions, epicanthoplasty should be taken into consideration. Firstly, epicanthoplasty is an effective procedure to correct the wide inner canthal distance (ICD) and improve facial harmony. Secondly, when a high-lying eyelid crease is pursued, the existence of epicanthal fold may create a semilunar and unnatural eyelid appearance. Moreover, if an outer-type double eyelid is preferred, which means the crease should run parallel to the ciliary margin near the inner canthus, concomitant epicanthoplasty will be a guarantee of an esthetically satisfying result because it is efficient to prevent crease splitting caused by epicanthal fold stretching.

An “epicanthal fold” usually denotes a skin fold from the upper eyelid that covers the inner part of the eye. An underdeveloped nasal root and an excess of horizontal medial canthal skin relative to the vertical skin shortage were considered to be the etiological factors,<sup>1,2</sup> and various surgical techniques that mainly focus on skin release, rotation, and excision have been reported to correct the unsightly skin fold, such as Z-plasty, V-Y advancement, W-plasty, and skin redraping methods.<sup>3-8</sup> However, prominent scar formation and postoperative relapse of the epicanthal fold remain as significant problems in many of these procedures.

Recently, with a progressive understanding of the epicanthal fold, the essential role of orbicularis oculi muscle on the formation of the epicanthal fold has been emphasized. According to the anatomical study of the epicanthal fold, the preseptal part of orbicularis fasciculi runs obliquely around the epicanthal fold area, and its direction coincides with the direction of the epicanthal fold.<sup>9-11</sup> So here comes a reasonable conclusion that the tension from the preseptal orbicularis muscle obliquely running around the medial canthus is an important anatomical and etiological factor of the epicanthal fold.

On the basis of this theory, surgical procedures dealing with orbicularis oculi muscle draw more attention. However, the absence of consensus makes this procedure differ from person to person, and muscle resection is rarely described in detail in published articles. Here, we report our experience in skin incision design and orbicularis oculi muscle treatment in epicanthoplasty. The purpose of this study was to introduce a practical technique of epicanthoplasty combined with double-eyelid plasty. It has been applied to a large number of patients in the past four years. With specific modifications, the technique enables an inconspicuous

scar and esthetically stable and reliable results, with highly satisfactory feedback.

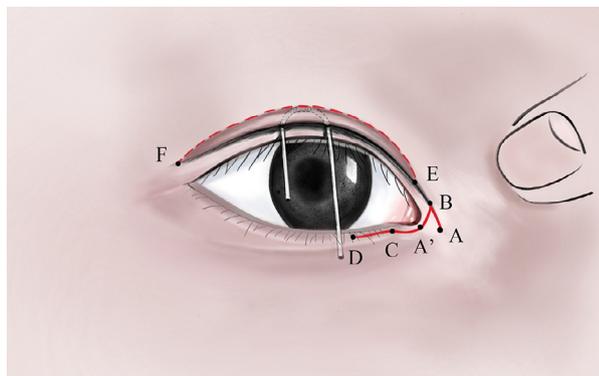
## Patients

From January 2015 to February 2019, 475 patients (472 female and 3 male) underwent double-eyelid blepharoplasty combined with epicanthoplasty using this technique. All the patients fulfilled the following criteria: (1) diagnosed as congenital single eyelid or failed from previous double-eyelid procedures; (2) presented with bilateral epicanthal folds that partially or completely cover the lacrimal caruncle; (3) without any history of epicanthoplasty; and (4) common ocular diseases, such as blepharoptosis, infection, and epiphora, should be excluded through regular preoperative eye examination. The age of patients ranged from 16 to 43 years, with an average age of 26 years. The follow-up period ranged from 2 to 38 months, with a mean period of 16 months postoperatively. This study was approved by the Institutional Review Board of Plastic Surgery Hospital, Chinese Academy of Medical Science (CAMS), and Peking Union Medical College (PUMC). Written informed consent was obtained from all patients.

Digital photographs were regularly taken before the surgery and when patients came back for postoperative follow-up. ICD (distance between the inner canthus) and the outer canthal distance (OCD, distance between the outer canthus) were measured based on the digital photographs by a single-blinded observer using WonderWebware.com Screen Ruler 4.3 (Melanto Ltd., Stara Zagora, Bulgaria). To minimize the influence of individual difference, the ratio of ICD to OCD (ICD/OCD) was calculated for each patient. Statistical analysis was performed using Wilcoxon signed-rank test.

## Preoperative preparation

All patients were instructed to remove their makeup and confirm the surgical design through preoperative consultation. According to the surgeon's experience as well as the patient's personal preference, the surgeon provided a preliminary plan. By simulating the upper eyelid outline with a clip and pulling the inner canthal skin toward the nasal root with the thumb, the patient would have a general understanding of the postoperative effect. Generally, an incisional line at a height of 7-8 mm from the margin of the eyelash was appropriate for most Chinese patients. According to our experience, a supratarsal crease of this width was able to achieve a natural and distinctive double eyelid, which is harmonious with the Asian face.<sup>12</sup> The position



**Figure 1** The schematic diagram of the combining technique. Point A is the desired location for the new medial epicanthus. Point A' is the medial most point, located 2-3 mm medial to the lacrimal lake. Point B is located on the newly formed supratarsal crease. The length of BA is approximately equal to BA'. Point C is at an outer position where the subciliary line meets the vertical line passing through the inferior lacrimal punctum. Point D is the end point of the lower eyelid incision. Points E and F are the medial and lateral end points of the upper eyelid incisional line, respectively.

of the new medial canthus was determined by the severity of the epicanthal fold, the intercanthal distance, as well as the desired height and shape of the palpebral crease. If the patient had any personalized requirement, necessary adjustment could be made accordingly to achieve a more satisfying result.

## Surgical procedure

All surgeries were performed with patients in the supine position. Markings were made using methylene blue as shown in Figure 1. With the eyes in the primary gaze position, points E and F were marked as the medial and lateral ends of the supratarsal crease incision, respectively. Point A represented the desired location for the new medial canthus. The nasal skin was pulled medially to fully expose the inner canthus, and Point A' was marked 2-3 mm medial to the lacrimal lake. Point B was on the newly formed supratarsal crease that made the length of BA approximately equal to BA'. Point C was marked at an outer position where the subciliary line met the vertical line passing through the inferior lacrimal punctum. Point D was marked at the end of the lower eyelid incision. The position of point D was determined by the severity of the epicanthal fold. Subsequently, the marking points were connected as incisional lines (E-F, A-B, and B-A'-C-D, marked as red lines in Figure 1). The curvilinear incisional line passing through points A', C, and D paralleled the lid margin approximately 1 mm below the eyelashes. A skin bridge was reserved on purpose, as point B and the medial end of upper eyelid incision were not connected by the incisional line.

To facilitate the skin incision with adequate tension, incision around the inner canthus was made first. Under local anesthesia with a solution containing 2% lidocaine hydrochloride and 1:100,000 epinephrine bitartrate, line A-B

and curvilinear B-A'-C-D was incised according to the designed markings. Proper digital traction toward the nasal root on the inner canthal skin allowed precise and smooth incision. Undermining carefully with scissors superficial to the orbicularis oculi muscle fully mobilized the flap ABA' and skin around the inner canthus.

Next, the upper eyelid blepharoplasty was performed prior to the epicanthoplasty, using a modification of Park's technique, which had been described in detail in a published article.<sup>12</sup> The upper eyelid incision was made with a size-11 sharp knife through the skin into the orbicularis oculi muscle. Then a strip of skin and a narrower orbicularis oculi muscle strip were excised using scissors. A small amount of muscle retained at both superior and inferior edges of the elliptical incision was important to prevent an incisional depression. Incising along the superior margin of the orbicularis oculi muscle to expose the orbital septum and removing fat from the central and nasal compartment were performed in a conservative fashion. The over-resection of the septal fat may aggravate the supratarsal hollow. For patients with sunken upper eyelids, the septal fat was kept intact or slightly removed. Adequate cauterization was necessary to prevent intraseptal bleeding when fat excision was completed. The pretarsal orbicularis oculi muscle was pulled downward gently with tweezers to expose the superior border of tarsus, and the orbicularis of the pretarsal lip was fixed to the superficial portion of tarsus with 6-0 silk sutures at the mid-pupillary and medial- and lateral-tarsus points. The fixation position on the tarsus determined the tightness of the pretarsal skin and the height of the upper eyelid crease. To prevent senile lateral sagging, superior and inferior muscle cuffs near the lateral canthus were stitched together with 6-0 silk sutures.

## Management of the inner canthal region

When the key procedures of double-eyelid plasty had been completed, the management of the inner canthal region was carried out according to the newly formed tension distribution pattern. The rich fibro-adipose tissue was separated subcutaneously to dissect the overlying skin from the surface of the orbicularis oculi muscle around the inner canthus. Extreme caution should be taken to avoid unexpected penetrating when subcutaneous dissection is being performed with scissors under the retained skin bridge (Figure 2). It was important to fully mobilize the overlying skin before muscle resection and skin trimming. The dissection area was about 5 mm medial to point A; hence, the inner canthal skin was sufficiently prepared with less tension for anchoring, whereas the skin surface was contoured with a smooth transition to the thicker nasal skin.

Selective removal of the orbicularis oculi muscle was the crucial procedure to correct the epicanthal fold. Excision of the hypertrophic musculature commenced at the medial end of the upper eyelid incision. The skin of the epicanthal fold was removed with skin hooks, and then a strip of orbicularis oculi muscle was removed along the direction of the supratarsal incision. The resected part was a triangular muscle block mainly composed of the preseptal portion of the orbicularis oculi muscle as well as a small amount of the pretarsal portion (Figure 3). The orbicularis oculi



**Figure 2** Subcutaneous dissection was performed with scissors under the retained skin bridge.

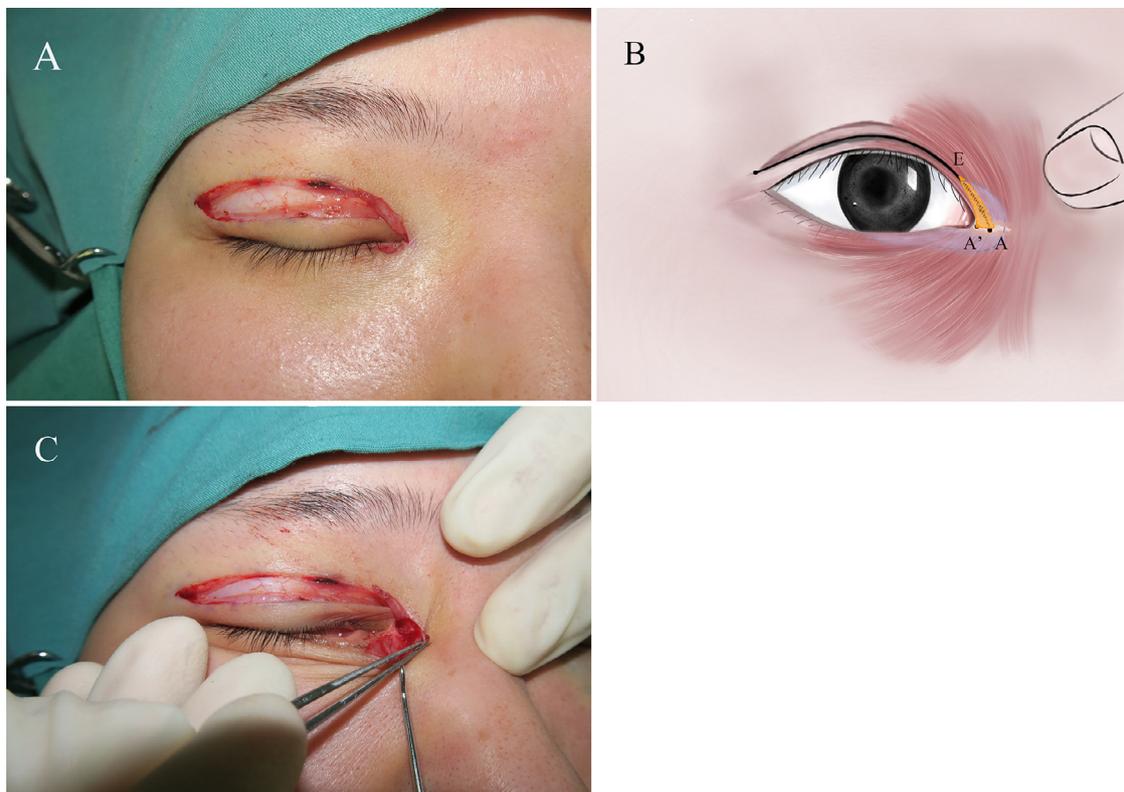
muscle of the lower eyelid remained intact because it was not directly involved in the epicanthal fold formation. The purpose of selective muscle removal was not only to eliminate the strain coming from the oblique direction muscle but also to debulk the thickening muscle that aggregates in the inner canthal region when the eyes open. Once subcutaneous dissection and muscle excision were completed, the medial canthus would be spontaneously redraped to the designed position as the abnormal tension in the epicanthal fold was sufficiently released (**Figure 4**).

For skin closure, point A' was sutured to point A on the medial canthus, and flap ABA' was removed accordingly to smoothen the skin surface. Excess skin on the subciliary incision was meticulously trimmed off to avoid the dog-ear deformity. Incision on the upper eyelid was closed in a skin-pretarsal fascia-skin maneuver, which means the skin at each cutting edge, thin layers of subcutaneous tissue, and pretarsal fascia were sutured together with 7-0 nylon sutures. It was helpful to form cicatricial adhesion between the skin and pretarsal fascia, which would provide more guarantee of the long-lasting supratarsal crease.

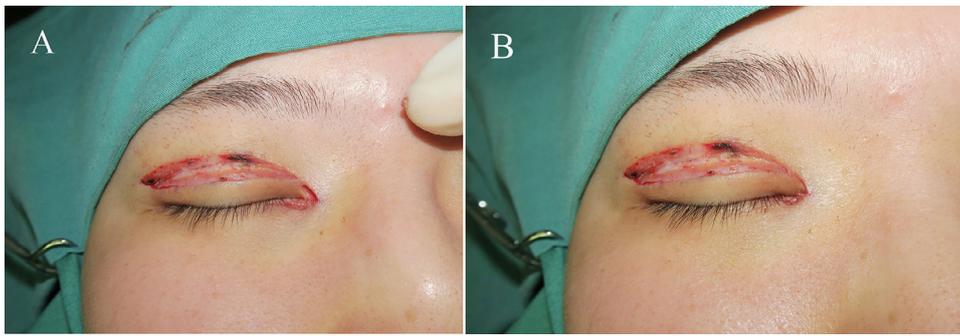
### Postoperative care and outcome assessment

After the surgery, patients were recommended to return for dressing change on the first day. All stitches were removed on the sixth day after the operation.

Digital photographs were taken on close follow-up, and patients were asked to self-evaluate the final cosmetic results. The measurement of satisfaction was graded as excellent, good, fair, or poor according to the following considerations: the symmetry and contour of the eyes and the stability of the esthetic outcome and scar formation. For patients who could not complete the follow-up, telephone interviews were performed to collect the relevant information.



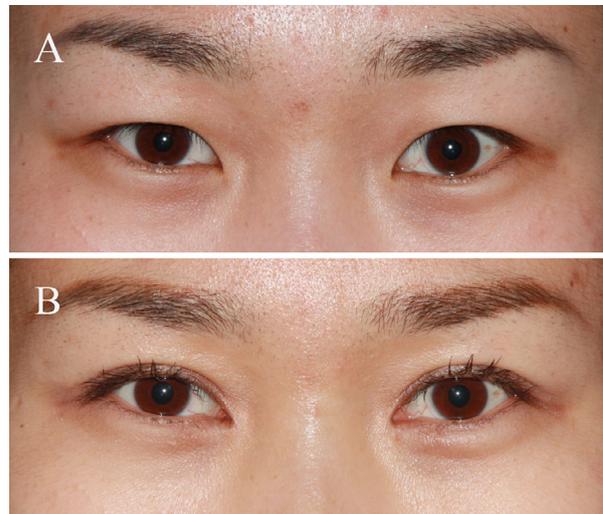
**Figure 3** (A, B) Along the direction of the supratarsal incision, a triangular muscle block of the orbicularis oculi muscle is removed. The region of subcutaneous separation is indicated in purple. (C) The superficial layer of the orbicularis oculi muscle that originates superiorly from the medial canthal tendon is removed, whereas the orbicularis muscle inferiorly attached to the medial canthal tendon is carefully protected.



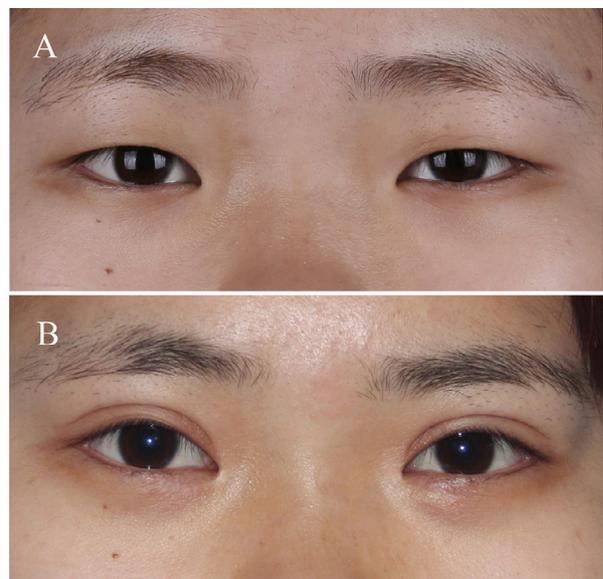
**Figure 4** When the abnormal tension from the orbicularis oculi muscle was completely released, the medial canthus spontaneously redraped to the designed position and the excess skin on the subciliary incision was easily identified.

## Results

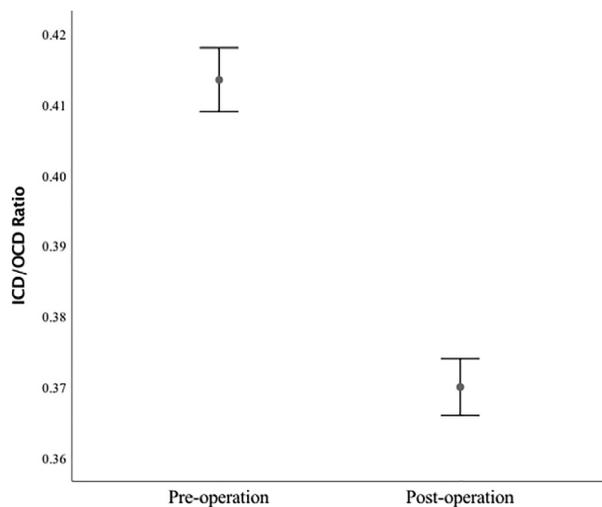
During the past 4 years, 475 patients underwent epicanthoplasty and concurrent double-eyelid plasty using this method. All patients were Chinese with an average age of 26 years, and most of them were female (472/475). Regardless of the type and severity of the epicanthal fold, this combined technique was applied to all patients. The follow-up period ranged from 2 to 38 months, with a mean period of 16 months. Short-term complications, such as swelling, bruising, or mild redness of the surgical scar around the inner canthus, were commonly observed. However, they were usually spontaneously relieved over a period ranging from weeks to months. None of the patients complained of lacrimal apparatus injury, hematoma, infection, suture migration, or hypertrophic scar formation. Ninety-seven percent of the patients (459/475), including revision cases failed from previous surgeries, were satisfied with surgical outcomes and graded the esthetic results as excellent. Standard photographs were taken from 84 patients for postoperative follow-up. For most patients, the contour of inner canthus was naturally improved and no conspicuous scar could be noted on the medial canthal region (Figures 5 and 6). Overcorrection of the epicanthal fold was avoided during surgery because the inner canthus that was formed by an acute angle could leave a calculating and fastidious impression on Chinese patients. Besides, a narrow intercanthal distance caused by overcorrection was a tough problem detrimental to facial harmony. Thus, moderate correction of the epicanthal fold was important for achieving cosmetic results. According to the photographic measurement, the pre- and postoperative ICD/OCD showed a statistically significant difference ( $P < 0.001$ , Wilcoxon signed-rank test). The preoperative mean ICD/OCD ratio was 0.41 (range, 0.37-0.47), whereas the postoperative one was 0.37 (range, 0.36-0.43). The mean reduction ratio in ICD/OCD ratio was 0.04 (range, 0.02-0.06) (Figure 7). As the expected ICD was approximately one third of the OCD, according to the facial esthetic standards, the postoperative results showed a significant improvement in the palpebral fissure proportion. Although for most patients the ultimate ICD failed to meet the requirement of a perfect facial proportion, the naturally improved cosmetic outcome is consistent with the ethnic characteristics of East Asians, with a high degree of acceptance and satisfaction. No recurrence



**Figure 5** (A) Preoperative view. (B) Three months after surgery. No conspicuous scar was observed around the inner canthus.



**Figure 6** (A) Preoperative view. (B) Eighteen months after surgery.



**Figure 7** The assessment of the ICD/OCD ratio before and after surgery. A significant improvement in the palpebral fissure proportion was shown postoperatively ( $P < 0.001$ , Wilcoxon signed-rank test).

of the epicanthal fold was observed up to 38 months postoperatively.

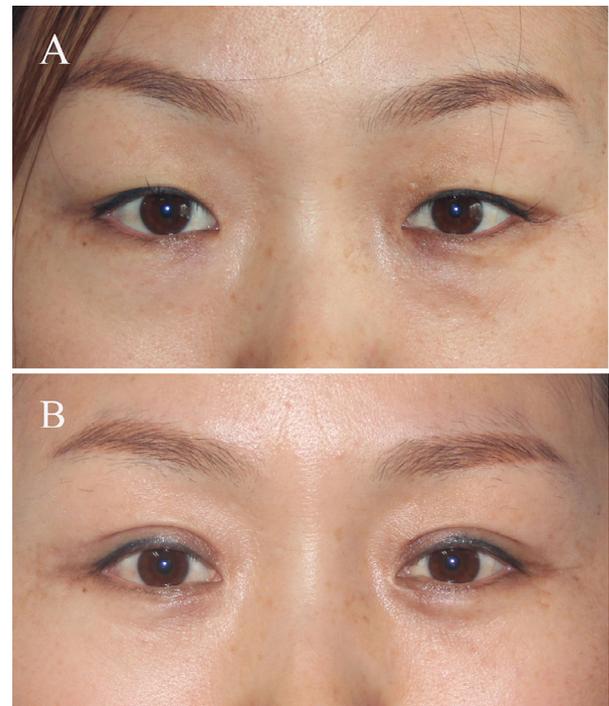
Unsatisfactory fold formation near the inner canthus was observed in five patients, whereas palpebral fold asymmetry was noted in eleven patients. To improve the double-eyelid formation near the medial canthus, through a small incision, adequate preseptal orbicularis muscle was removed along the palpebral crease, and then both muscle cuffs were fixed to the deep connective tissue using silk sutures. As to the palpebral fold asymmetry, differences in the orbicularis-tarsus anchoring levels were considered the main reason. Thus, fixation adjustment was employed to revise the problem. All patients were satisfied with revision effects.

## Discussion

A plump single eyelid with a medial epicanthal fold is the morphological feature of the East Asian population. On the basis of this anatomical characteristic, eye exposure is limited both horizontally and vertically. With the presence of the epicanthal fold, epicanthoplasty and double-eyelid surgery are the optimal combination to achieve a more appealing esthetic improvement. Nowadays, combining blepharoplasty and epicanthoplasty has been one of the most popular periocular surgeries in East Asia.

For double-eyelid plasty, a variety of different techniques have been introduced, each with pitfalls and benefits.<sup>13-16</sup> In this study, we used the orbicularis-tarsus fixation approach for incisional blepharoplasty.<sup>12</sup> It is a modification of Park's technique.<sup>14</sup> Instead of levator aponeurosis, the tarsal plate is used as the object for solid anchoring with the orbicularis oculi muscle. According to our experience in practical application, it is a feasible approach that provides a robust and stable outcome.

Nowadays, various techniques for epicanthoplasty have been described. Based on the type of skin flap, they can be divided into two categories. One is the advancement flap, such as a Y- to V-plasty and redraping technique.<sup>17-21</sup> The



**Figure 8** (A) Preoperative view. (B) Six months after double-eyelid plasty, epicanthoplasty, and concomitant transcutaneous lower blepharoplasty. The surgical outcome was esthetically satisfying, and no conspicuous scar was observed.

other category is the transposition flap, including a Z-plasty and its various modifications.<sup>4,22-24</sup> As the intermuscular fibers of the oblique direction preseptal orbicularis muscle are now considered as the causative factor of epicanthal folds, the key surgical step has converted from skin flap design to orbicularis oculi myectomy. In other words, the type of skin flap plays a minor role in the successful elimination of the epicanthal fold. The emphasis of the flap design is to offer adequate intraoperative exposure with concealed skin incision and minimal wound tension. As an unfortunate fact, the medial canthal area has a tendency for hypertrophic scarring in Asians. It has been shown that even the most meticulously performed procedure in this area may be complicated by an esthetically unpleasant scar, especially when the scar is vertical to the lower eyelid margin or extends to the nasal skin region. In this procedure, we employ a redraping flap similar to some previous techniques.<sup>7,20</sup> Compared with the transposition flap, the simply designed redraping flap can meet all the aforementioned emphases. More importantly, as the incision is hidden around the ciliary margin, the thicker nasal skin remained uninvolved and no vertical incision to the lower eyelid is necessary. As a result, the formation of unsightly prominent scarring is effectively prevented. Besides, when concomitant lower lid blepharoplasty is considered, the incision of epicanthoplasty enables extended subciliary incision for concurrent transcutaneous lower blepharoplasty, which can achieve excellent esthetic results (Figure 8).

The selective resection of the orbicularis oculi muscle is the essential part of epicanthoplasty. According to one published study that compares epicanthoplasty with or without muscle removal, hypertrophic scarring was significantly

reduced when concomitant orbicularis oculi muscle resection was performed.<sup>25</sup> Although limited by a relatively small sample size, the observation indicated the importance of muscle resection. Based on several existing studies focusing on the composition of the epicanthal fold, the anatomy of the epicanthal fold has been well understood. The orbicularis oculi muscle that obliquely runs through the medial canthus is found to be the core structure of the epicanthal fold. Only the preseptal part is involved and a connection of the upper-to-lower preseptal muscle was observed as a unique interrelationship in epicanthal fold formation.<sup>9,10</sup> Besides, when the eyes open, the orbicularis oculi muscle near the inner canthus moves medially to concentrate as a thicker muscular mass. As the pretarsal part becomes superficial to the preseptal part, the increased tissue volume may accentuate the epicanthal fold.<sup>26</sup> Considering all the formative factors, the orbicularis oculi muscle in a specific region is removed in our technique, which consists of the preseptal part and a small amount of the pretarsal part. Resection of the preseptal muscle significantly reduces the muscular tension within the epicanthal fold, whereas the pretarsal muscle removal eliminates the volume thickening effect following muscle overlap. Once the abnormal tension is sufficiently released, point A' should automatically move to the newly designed medial canthal point A and remain in place without suture fixation (Figure 4). As a result, the skin is closed by the interrupted suture in a tensionless pattern. Our observation, along with the previous mentioned study,<sup>25</sup> suggests that the importance of muscle resection is not only in epicanthal fold correction but also in scar prevention. We hope it will spark interest in the future studies that focus on the optimal practice of orbicularis myectomy in epicanthoplasty.

There is one more surgical detail of muscle resection that should be stressed. In this technique, only the superficial layer of orbicularis oculi muscle originating superiorly from the medial canthal tendon is removed, whereas that inferiorly attached to the medial canthal tendon is carefully protected. In some techniques, especially when medial canthal tendon plication is applied, the orbicularis oculi muscle superficial to the medial ligament, including part of the inferior portion, is resected thoroughly for a clear exposure.<sup>25,27,28</sup> However, disconnection of the orbicularis muscle from the medial ligament leads to further risks. Firstly, the orbicularis oculi muscle belongs to the sphincter muscle and acts as a major contributor to lower eyelid tone. Surgical disruption of the muscle-tendon attachment will increase the horizontal laxity of the lower eyelid. As the lower eyelid is prone to undergo age-related changes, improper muscle resection may increase the potential risk of lower eyelid festoons or even ectropion. On the other hand, the orbicularis oculi muscle is involved in the complex dynamic expressions around the orbital region. Discontinuity of the muscle fibers will disrupt the normal contraction pattern, which contributes to unexpected deformity. The laterally displaced lower eyelid muscular pouch is a common clinical manifestation. The lower lid malposition becomes even more obvious due to tension imbalance when the muscle contracts (Figure 9). Generally speaking, preservation of the orbicularis muscle inferior to the medial tendon is necessary to maintain the normal and balanced tension, especially



**Figure 9** The typical manifestation of the laterally displaced lower eyelid muscular pouch. The muscular discontinuity near the inner canthus was more obvious on the left eye because of the hypertrophic orbicularis muscle.

for those individuals presenting redundancy in the lower eyelid.

For all the patients in this study, the epicanthoplasty and a concomitant double-eyelid plasty were performed. To improve the esthetic outcome, a short and narrow skin bridge was reserved near the inner canthus. The discontinuity of skin incision is inconvenient for the following procedures; however, it is regularly applied out of some considerations. Compared with stiff scar tissue, the skin has good compliance because of its softness and elasticity. In this technique, dissection superficial to the orbicularis oculi muscle is carefully performed under the intact skin bridge for full mobilization. After the surgery, with repeated movement of the eye, the retained skin will naturally redistribute according to the tension line direction of the supratarsal crease, and a new muscle-skin adhesion will be built. In this way, the retained skin plays a role as a “bridge” to form a natural smooth curve that connects both incisional ends, and no bulging caused by the retained skin has been observed in a long period of follow-up. Hence, the skin bridge is mainly formed to avoid the unpleasant rigid appearance caused by scar formation. Furthermore, any scar resulting from skin incision, when it is close to the medial canthus, remains exposed and cannot be concealed in the palpebral crease. Based on this point, keeping an intact skin bridge contributes to minimize the postoperative scar.

## Conclusions

This technique combines epicanthoplasty and modified Park's double-eyelid plasty to achieve an elongated and more balanced eye shape in Chinese patients. It is simply designed and easily mastered. With resection of the orbicularis oculi muscle in a specific region, the epicanthal fold can be sufficiently corrected regardless of the type. According to our practical experience, this procedure enables satisfactory curved supratarsal crease and a lengthened palpebral fissure with minimal scarring, and no recurrence or significant complication has been observed in the long follow-up period.

## Funding

None.

## Declaration of Competing Interest

The authors have no financial or conflicts of interest to disclose.

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