

Orbicularis-Tarsus Fixation Approach in Double-Eyelid Blepharoplasty: A Modification of Park's Technique

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Abstract

Background Incisional double-eyelid blepharoplasty is widely applied because of its extensive indications and robust results. The orbicularis-levator fixation method is an incisional approach that provides stronger adhesion than traditional techniques. However, there remains the risk of postoperative relapse or suture spitting out.

Methods The authors introduced a modified technique for supratarsal crease formation. When necessary soft tissue removal was completed, the orbicularis oculi muscle was anchored on the tarsus. Then the muscle edges near canthus were reattached to prevent muscle retraction. For skin closure, the skin-pretarsal fascia-skin maneuver was adopted to enhance cicatricial adhesion.

Results Six hundred and fifty-nine patients underwent double eyelidplasty by the same surgeon using this modified technique. Patients were followed up from 2 to 38 months, with a mean period of 15 months. Short-term complications included mild edema, bruising or reddish change of the upper eyelid, yet all gradually relieved in 6–8 weeks. Fourteen cases of palpebral fold asymmetry and nine cases of unsatisfactory fold formation near the inner canthus were encountered, and all the defects had been well improved by revision surgeries. Ninety-five percent of the patients were satisfied with the long-term

outcomes, which showed as natural and well-defined palpebral folds without scar hypertrophy, suture spitting out or crease depression. Besides, no supratarsal crease drooping or disappearing was observed 3 years postoperatively.

Conclusions The authors introduced an orbicularis-tarsus fixation method for upper eyelid blepharoplasty. It is a reliable technique that enables high feasibility and long-lasting result, and with lower risk of suture spitting out.

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Keywords Blepharoplasty · Orbicularis-tarsus fixation · Technique modification

Introduction

Double eyelidplasty has been the most popular esthetic procedure for years in East Asia. Compared to puffy upper eyelids with relaxed skin, eyes with well-defined supratarsal folds are considered more attractive. However, about 50% of East Asians are born without an upper eyelid fold [1]. That is the reason why double-eyelid blepharoplasty remains popular.

Extension of the levator aponeurosis inserting onto the skin surface is the anatomical base for double-eyelid formation. In Asian people's eyelids, the aponeurotic fibers form a weaker attachment to the dermis at a lower level, resulting in a less distinct lid fold. Besides, the preaponeurotic fat creates the characteristic fullness appearance of the upper eyelid [2]. Since the first

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description of double eyelidplasty by Mikamo was published in 1896 [3], various procedures have been introduced to form a more distinct lid crease. According to the surgical approach, double eyelidplasty can be divided into non-incisional and incisional-based methods, both aiming at simulating the physiological levator-skin linkage [4–9]. Formation of scar tissue between the levator aponeurosis and eyelid skin is the essential fixation mechanism of double eyelidplasty. However, lots of factors are involved in the cicatrization process, which may affect the ultimate postoperative result. Among all these methods, incisional-based blepharoplasty has been considered the most reliable approach with the widest indications and robust results.

In 1999, Park described an orbicularis-levator fixation method for double eyelidplasty [10]. In this method, the supratarsal crease was formed by a fixation between the orbicularis oculi muscle and the levator aponeurosis. According to Park, it provided stronger adhesion than the previously described levator-skin and/or dermis fixation procedure and decreased the risk of suture spitting out due to the superficial placement. The orbicularis-levator fixation approach is now widely used as a mature double-eyelid surgery in China.

However, there are still some problems in Park's method. Although a permanent suture material is used for the fixation between the orbicularis oculi muscle and levator aponeurosis, the adhesion is not solid enough. Each time the eyes open, as the levator moves upward, a strain develops between the levator and orbicularis. Because the levator aponeurosis is a thin layer of dense connective tissue, the recurrent cutting force from suture material may gradually weaken the fixation, leading to potential relaxation. Besides, as the levator aponeurosis undergoes senile attenuation, this kind of adhesion is somewhat unsteady and recurrence is a common problem. Even Park mentioned the frequent relapse as a common complication without a good solution [11]. The problem of postoperative relapse has been corroborated by our clinical application using Park's method. According to our own experience, we have observed five cases of supratarsal crease drooping or relapse out of 30 patients, most of which occurred 3–6 months after blepharoplasty in the recovery stage

(Fig. 1). Although this observation lacks the support of larger numbers of patients, it hinders us from extensive application and motivates us to seek technical improvement. Apart from potential relapse, suture spitting out is another issue. The fixation on the orbicularis oculi somehow prevents the suture from penetrating through the superficial covering skin, but there remains the risk of suture migrating internally to irritate the cornea or conjunctiva, because only thin layers of tissue are left between the levator aponeurosis and eyeball.

To overcome these drawbacks, we introduce a modified technique for double eyelidplasty, which we call the orbicularis-tarsus fixation approach (Fig. 2). This novel method for crease formation enables firm fixation with a lower risk of suture spitting out.

Patients and Methods

Between January of 2015 and April of 2018, 659 patients (641 female and 18 male) underwent double-eyelid blepharoplasty using the modified approach. This study was approved by the Institutional Review Board of Plastic Surgery Hospital, Chinese Academy of Medical Science (CAMS) and Peing Union Medical College (PUMC). Written informed consent was obtained from all patients. The age of patients ranged from 17 to 52 years, with an average age of 29 years. All patients had either congenital single eyelids or had undergone a failed previous procedure. The follow-up ranged from 2 to 38 months, with a mean period of 15 months postoperatively. Details of personal information, operative procedures and outcomes were collected with patients' consent.

Preoperative Consideration and Surgery Design

Preoperative design was made with the patient in a sitting position. According to the surgeon's experience as well as the patient's personal preference, the height and shape of the palpebral crease line were preliminary determined. Then, the surgeon used tweezers to simulate a new upper eyelid crease and confirmed the result with the patient. If

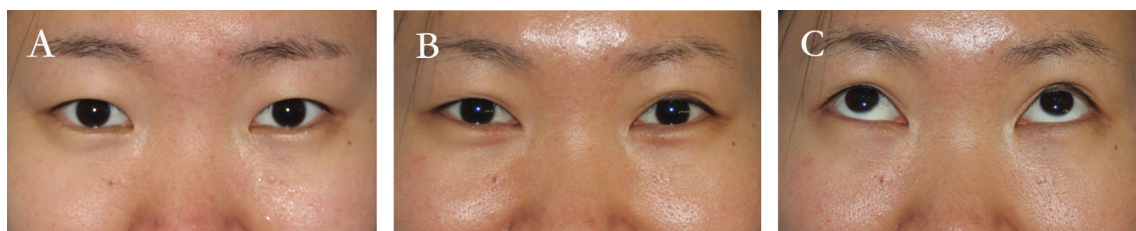
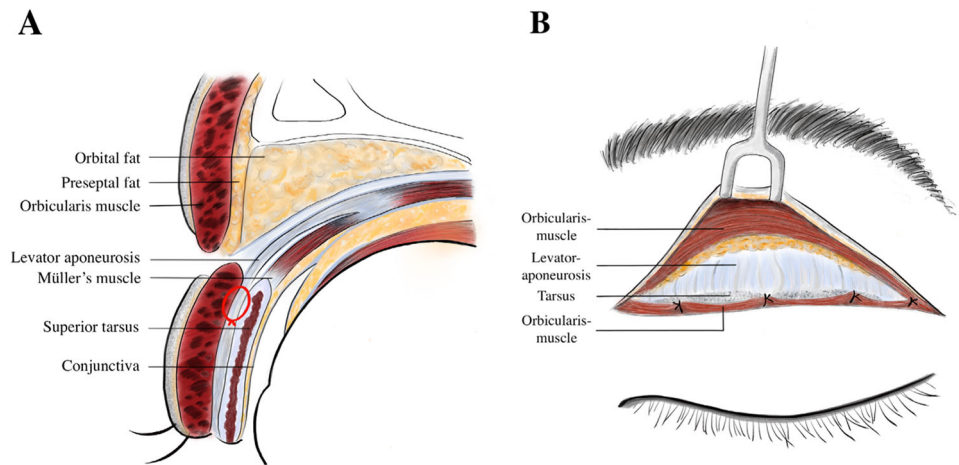


Fig. 1 a Preoperative view. b, c Six months after blepharoplasty using the Park method. Supratarsal crease disappearance was observed as a manifestation of postoperative relapse

Fig. 2 The orbicularis-tarsus fixation method



necessary, minor adjustment can be made in this stage. Generally, an incisional line at a height of 7–8 mm from the margin of the eyelash was appropriate for most Chinese patients. Because pretarsal skin was partially covered by the supratarsal fold in a primary gaze, and slight pretarsal skin retraction was inevitable, which both made the width of pretarsal show present narrower, we preferred a height of 7–8 mm for the supratarsal crease. According to our clinical observation, a supratarsal crease of this width was able to achieve a natural, distinctive and well-defined double eyelid for most Chinese. When the eyebrow distance was abnormal, or special requirements arose, individualized design was necessary to meet personalized needs. To improve upper eyelid laxity, an ellipse of skin would be excised during the procedure. The distance from the ciliary margin to the second incisional line was determined due to the extent of skin laxity. A simple method was to pinch the upper eyelid at the level of the lower incisional line with tweezers until the skin was tightly stretched and the eyelash started to move; then, the amount of excessive skin could be well estimated. For young patients, excessive skin resection may cause unsightly lash eversion or even lagophthalmos appearance, so meticulous surgical design was important.

There is one more issue that should be taken into consideration before the surgery. Patients with mild, especially latent, blepharoptosis were easily neglected without careful preoperative examination, which would result in unfavorable results. To avoid surgery failure, it was important to notice some typical manifestations. Asymmetry of eyebrows or lid creases, a multi-crease eyelid and a lower margin of the upper eyelid that covered too much cornea were common signs of aponeurotic ptosis. The levator function test was necessary to make a definitive diagnosis for all the patients with potential ptosis. Patients with good or fair levator function would accept simultaneous ptosis

repair, while cases with severe unilateral ptosis were excluded in this study.

Operative Technique

Step 1: Exposure

The patient was placed in the supine position in the operation room. Under local anesthesia with solution containing 2% lidocaine hydrochloride and 1:100,000 epinephrine bitartrate, the skin incision was made according to the designed markings. Adequate anesthetic injection, digital traction and light pressure by the surgeon on the eyelid skin allowed for a precise and smooth incision. Then, a strip of upper eyelid skin and a narrower orbicularis oculi muscle strip were excised using scissors, which meant that a small amount of muscle was retained at both the superior and inferior edges of the elliptical incision (Fig. 3). It was important to prevent late incisional depression. When the dissection continued to the orbital septum, excessive orbital and preaponeurotic fat was removed (Fig. 4). Usually, the orbital septum was incised laterally. The lateral extension of the central orbital fat compartment was the leading cause of a puffy upper eyelid, which may also hinder the formation of a temporal double crease as designed. If the bulging orbital fat gave a poor contour of the epicanthic supratarsal crease, excision of the medial or nasal compartment was adopted. Once the septum was opened, redundant fat tissue may budge out with gentle pressure. Fat removal should be conservative because over-resection of fat may leave a hollowed appearance, which is an unfavorable complication that significantly impairs the postoperative result. Once the orbital septum was opened, the preaponeurotic space was exposed. Opening the septum cephalad protected the underlying levator aponeurosis. It was a membranous tissue with a white glistening surface that could be easily distinguished from the orbital septum.



Fig. 3 **a** Excise a narrow orbicularis oculi muscle strip, and the orbital septum is exposed because of muscle retraction. **b, c** Preseptal fat is a thin layer of fat tissue covering the septum



Fig. 4 **a** Open the orbital septum and redundant fat tissue may budge out with gentle pressure. **b, c** Remove moderate amount of fat to prevent the hollowing appearance of upper eyelid which is due to over-resection of orbital fat

Asking the patient to open the eyes while the upper eyelid skin-muscle flap was retracted, and a distinctive anterior–posterior contraction toward the orbital rim were reliable methods to confirm the aponeurotic structure. On the contrary, when the levator aponeurosis was gently grasped, the patient would have difficulty in opening the eye. Pulling the pretarsal orbicularis oculi muscle downward gently with tweezers and the superior border of tarsus where the extension of levator aponeurosis across the tarsal plate was distinctive to observe. (Figure 5).

Step 2: Orbicularis-Tarsus Fixation

In this step, the position in which the orbicularis oculi muscle was anchored to the tarsus determined the double-eyelid contour. The orbicularis of the pretarsal lip was



Fig. 5 Elevate the orbital fat and gently pull the pretarsal orbicularis oculi muscle downward, the pearl white levator aponeurosis is exposed. The superior border of tarsus is also distinctive to observe

fixed to the superficial portion of the tarsus with 6-0 silk sutures at the mid-pupillary, medial- and lateral-tarsus points. The needle is passed through the muscle cuff close to the skin margin, and then through the tarsus with certainty and making sure that the knot is deeply buried (Fig. 6). For each fixation, the lid should be lifted to ensure the suture is not exposed posteriorly on the tarsus to prevent corneal abrasion. The fixation position on the tarsus determines the tightness of the pretarsal skin and the height of the upper eyelid crease. Usually, fixation points near the superior margin of the tarsus were chosen. In this maneuver, the pretarsal skin-muscle flap was tightly stretched, so it minimized the risk of a bulky pretarsal lip caused by the retraction of the remaining orbicularis muscle (Fig. 7). However, improper fixation that is set too high may lead to eyelash eversion or unesthetic showing of the red tarsal margin.

For patients diagnosed with blepharoptosis, a ptosis repair should be undertaken in combination with blepharoplasty. If an attenuated and elongated levator aponeurosis was found during the surgery, aponeurotic plication with 5-0 silk suture was adopted. Sometimes we observed incomplete attachment of the levator aponeurosis to the tarsus, so anchoring the tarsus to the remaining levator was a preferred surgery choice. According to the practical condition, three to five sutures that repositioned medially to laterally were used for ptosis correction. When completed, the patient is asked to open the eyes and adjust the sutures if necessary. The optical result was to recover a



Fig. 6 **a** Pass the needle through the muscle cuff that is close to the skin margin. **b** The needle then passes through the superficial portion of the tarsus with certainty. **c** Cut the suture knot as short as possible and make sure it is deeply buried



Fig. 7 Orbicularis of the pretarsal lip is fixed to the tarsus at the mid-pupillary, medial-tarsus and lateral-tarsus points. When the orbicularis-tarsus fixation procedure is completed, the pretarsal skin-muscle flap is tightly stretched

normal eyelid level and contour when the eyes were in the primary position.

Step 3: Incision Closure

To close the skin incision, at each cutting edge, thin layers of subcutaneous tissue and pretarsal fascia were sutured together with 7-0 nylon suture (Fig. 8).

Because the structure of the tarsus transformed into support ligaments at both the medial and lateral canthus, the orbicularis oculi muscle nearby could not be effectively fixed to the tarsus in the previously mentioned *orbicularis-tarsus fixation* step. Near the inner canthus, pretarsal and supratarsal muscular margins were close to each other, so orbicularis reattachment would be combined with the skin



Fig. 8 For incision closure, at each cutting edge, a thin layer of subcutaneous tissue and pretarsal fascia are sutured together to provide one more guarantee of a long-lasting supratarsal crease

closure, and a small bite of orbicularis oculi muscle on each incisional margin was included in the suture fixation (Fig. 9). In this way, muscle reattachment near the inner canthus was completed. Considering the lateral area would tend to descend in the aging process, reattachment of the muscle cuff was used to prevent later sagging. Thus, before skin closure, the superior and inferior incisional margins of the orbicularis near the lateral canthus were stitched together with 6-0 silk suture (Fig. 10).

Patients are asked to open and close the eyes several times to check the result, and necessary adjustments in height and contour can be made until symmetric and desired appearances of both eyes are achieved (Fig. 11).

Postoperative care and assessment of outcomes

After the surgery, dressings on the operative region are kept for 24 h. The next day, the patient was asked to come for wound inspection. Then, the dressing was removed leaving the incision exposed. Taking oral antibiotics for 3 days was advised to protect against infection. For the first 3–5 days after the procedure, cool compresses with ice packs were helpful to prevent hematoma formation. Then, hot compresses were used to relieve swelling. Six days after the surgery, the patient returned for the removal of skin sutures.

During the follow-up period, patient satisfaction about the final esthetic results was graded as excellent, good, fair or poor according to the following considerations:



Fig. 9 Reattachment of muscle cuff near the inner canthus is included in the skin closure

Fig. 10 **a** Superior and inferior incisional margins of the orbicularis near the lateral canthus are stitched together. **b** Orbicularis muscle reattachment is completed

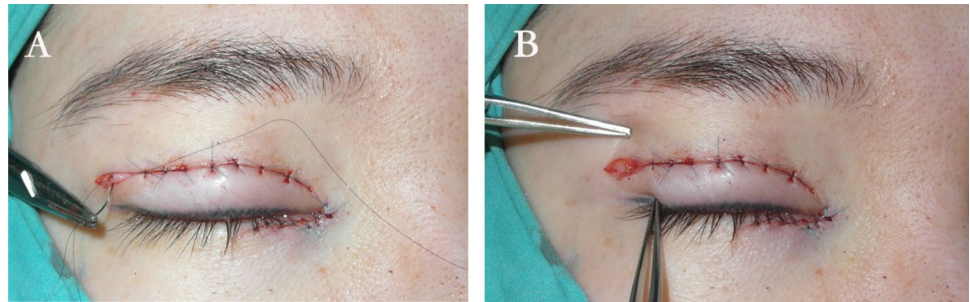
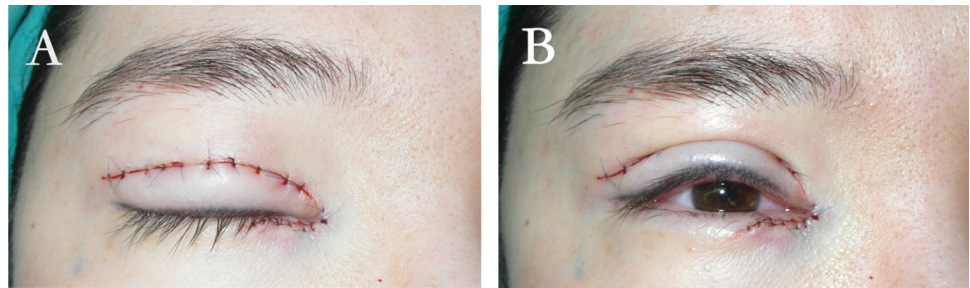


Fig. 11 **a** After skin closure, the incision line is smooth without depression. **b** Immediate effect after the surgery. Make necessary adjustments to achieve best results



symmetry of eyes, contour of the upper eyelid crease, stability of postoperative outcome and scar formation. For patients who could not complete the follow-up, telephone interviews were performed to collect the relevant information.

Results

Six hundred and fifty-nine patients underwent upper blepharoplasty with this method. There were 641 women and 18 men, whose ages ranged from 16 to 52 years, with a median age of 29. All patients were Chinese. The follow-up period ranged from 2 to 38 months, with a mean period of 15 months. Five hundred and ninety-seven patients were primary cases, whereas sixty-two patients were secondary failure cases from previous procedures. The main reasons for revision included crease fading or disappearing, upper eyelid asymmetry, scar hypertrophy and/or depression. Epicanthoplasty was adopted as an auxiliary procedure for 313 patients, because correction of the Mongolian fold contributed to surgery outcomes. Twenty-three patients underwent ptosis correction through aponeurotic plication or reattachment between the levator aponeurosis and tarsus.

Short-term complications included mild edema, bruising or reddish change of the upper eyelid in some patients, which gradually dissipated in 6 to 8 weeks. Scar hypertrophy, granuloma formation, suture knot spitting out and crease depression were not observed. The palpebral fold was natural and completely invaginated in 2–3 months, with a smooth skin surface of the incision line in a downward gaze (Fig. 12). Most patients (95%, 626/659)

were satisfied with the outcomes, and they graded the esthetic results as excellent, including secondary failure cases from previous procedures and patients with blepharoptosis (Figs. 13, 14). Fourteen patients received revision because of palpebral fold asymmetry caused by differences in the orbicularis-tarsus anchoring levels. Unsatisfactory fold formation near the inner canthus was observed in nine patients. Through a small incision, adequate orbicularis muscle removal or fixation adjustment successfully revised the problem. All patients were satisfied with revision effects.

Discussion

Single eyelids and medial epicanthal folds are morphological features of Asian eyes. As an important esthetic structure, the shape of the eyes directly determines personal visage identity. With progression of cultural globalization, the public opinion of beautiful eyes has changed to wide palpebral fissures with double-eyelid creases, which makes the eyes full of vitality and spirit. For this reason, upper eyelid blepharoplasty remains one of the most popular esthetic surgeries among Asians, or even Asian Americans [12].

Compared with the non-incisional method, the incisional method is now widely used as a standard procedure for its wide indications and proven effectiveness. So far, a variety of different incisional techniques have been introduced, each with pitfalls and benefits. In summary, to form well-defined and long-lasting supratarsal creases, there are two essentials: removing redundant tissue when necessary

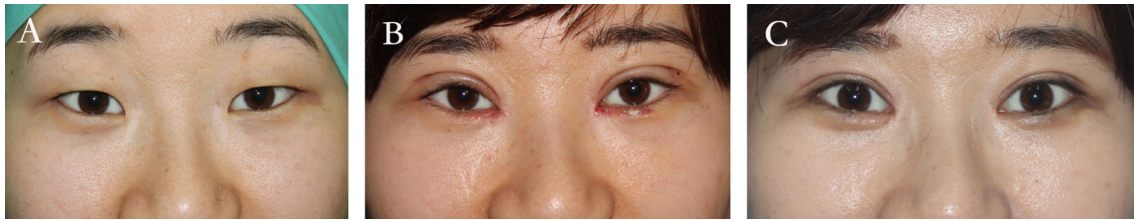


Fig. 12 **a** Preoperative view. **b** Seven days after blepharoplasty and epicanthoplasty. **c** Two-month postoperative result. The palpebral fold was natural and completely invaginated, whereas the pretarsal skin was tightly stretched



Fig. 13 A secondary case that requiring revision surgery because of unsatisfactory esthetic result of the previous incisional blepharoplasty. **a**, **b** Before the revision surgery. **c**, **d** Six months postoperative view



Fig. 14 A patient with mild unilateral eyelid ptosis. **a** Preoperative view. The right palpebral fissure was significantly narrower than the left. **b** Three months after surgery for ptosis correction and

blepharoplasty. **c** Eighteen-month postoperative result. The unilateral eyelid ptosis was well corrected, while the supratarsal crease was symmetric and natural for both eyes

and building a solid cicatricial skin-levator or skin-tarsus adhesion.

Upper eyelid skin laxity and periorbital fat herniation are preferable indications, because incisional blepharoplasty is effective for periorbital rejuvenation. Nowadays, the concept of volume preservation and restoration has gained increasing popularity [13–15]. Considering that youthful eyes are characterized by soft tissue fullness and tight supratarsal skin, excessive removal of skin, muscle or orbital fat may cause an aging appearance with hollowed eyes, or even unacceptable lagophthalmos.

Some surgeons propose an en bloc excision of skin and orbicularis muscle, because muscle left under the incision can cause a heavy, full lip appearance and interfere with the creation of a clean, distinct supratarsal fold [16, 17]. Resection of the orbicularis oculi muscle is now adopted as a regular procedure in open-incisional upper blepharoplasty, especially when excessive skin is removed. It is based on the following considerations. Firstly, removal of muscle can somehow ‘debulk’ the upper eyelid and prevent orbicularis sagging with aging [18]. Secondly, myectomy of the upper eyelid orbicularis can widen the lid aperture. Besides, muscle resection enables better exposure of the orbital septum, which facilitates the following procedures.

However, there is no consensus about how much muscle should be removed.

In this method, only a narrow strip of muscle is removed under the skin incision. Because the absence of the orbicularis oculi muscle layer at the upper eyelid crease may cause significant depression when eyes gaze downward or close, we preserve enough orbicularis muscle that the remaining edge of the muscle cuff is close to each other. In this way, the skin surface contour is able to remain natural and smooth without tension, minimizing scar formation and preventing incisional depression. According to the follow-up results, neither obvious crease depression nor scar hypertrophy has been observed in the long term (Supplemental Figs. 1-2).

In addition to orbicularis oculi muscle, skin and orbital fat resection also require careful management. Over-resection of the skin will narrow the space between the palpebral margin and the brow, potentially worsening brow ptosis in some patients and impairing lid function [19]. Therefore, evaluating factors that contribute to upper eyelid redundancy individually, and adopting meticulous and conservative maneuvers is of great importance to achieve esthetic enhancements.

In recent years, an orbicularis-levator-tarsus composite suture technique was reported and successfully applied for blepharoplasty [20]. According to this technique, the orbicularis oculi, the levator aponeurosis and the tarsal plate were fixed as a composite entity. The tarsal plate was included in this technique to provide firmer adhesion. Compared with this composite method and the classic Park's technique, in our approach, the orbicularis oculi muscle is fixed to the tarsal plate, without involvement of the levator aponeurosis. There are several considerations for the modification. Firstly, in the Park method, orbicularis-levator fixation buries the knot in the deep tissue plane to avoid suture migration to the skin surface. However, there is a certain risk of suture migrating internally, because the suture may gradually penetrate through the thin layers of tissue between the levator aponeurosis and conjunctiva. We have encountered several cases of this complication in our early practice using the Park method, some were our own patients and some underwent surgery elsewhere and came to us for revision (Supplemental Fig. 3). That is one of the original motives for the technical improvement. In contrast, the tarsus is a compact structure that is composed of dense fibrous connective tissue and sufficient tissue thickness. So it is suitable for solid anchoring, and the risk of suture penetrating is much lower. Secondly, the levator aponeurosis is a dynamic part of the upper eyelid. Each time the eyes open, the tendinous aponeurosis slides toward the orbital rim. So in the long run, as the aponeurosis undergoes senile attenuation, or the cicatricial fixation between the levator aponeurosis and orbicularis muscle loosens over time, drooping of the supratarsal fold or crease disappearance may happen [11]. On the contrary, the tarsus is an ideal structure to provide firm and stable anchoring with permanent suture. That is the main reason that the levator aponeurosis is not included in our fixation technique. In addition, the orbicularis sags like a hammock in aging eyes, carrying the skin with it. When the pretarsal orbicularis is fixed to the tarsus, muscle retraction or sagging (as shown in supplemental Fig. 4) is efficiently prevented, and the pretarsal skin is able to remain tightly stretched. What is more, the orbicularis-tarsus fixation method includes the extension part of the levator aponeurosis. Thus, this modified technique indirectly builds a reliable attachment between the levator aponeurosis and pretarsal skin-muscle flap, which is the anatomical foundation for double-eyelid formation. In summary, the orbicularis-tarsus fixation technique is a reliable and safe method.

To build a more solid fixation, we employ the skin-pretarsal fascia-skin maneuver for incision closure. Cicatricial adhesion develops between the skin and pretarsal fascia during the healing process providing one more guarantee of a long-lasting supratarsal crease. According to

our observation, no supratarsal crease drooping or post-operative relapse were encountered during a long period of follow-up (Supplemental Fig. 5).

Conclusions

This modified orbicularis-tarsus fixation technique is a feasible and reliable approach for upper eyelid blepharoplasty. It provides solid adhesion with robust and stable outcomes. Meticulous individualized preoperative evaluation and careful management of important procedures are essential for satisfactory results. When using this technique, the following principles should be considered:

- Remove tissue (skin, orbicularis oculi or orbital fat) that is truly excessive on the upper eyelid.
- The width of the orbicularis oculi muscle to be excised should be narrower than that of the skin removed.
- Meticulous hemostasis and clear exposure of important structures are important to surgical result.
- Orbicularis-tarsus fixation is the essential step that acquires more attention because the position of the orbicularis oculi muscle anchored to the tarsus determines the ultimate double-eyelid contour.
- Fixing the orbicularis oculi muscle to the tarsus and reattachment of the muscle cuff near the canthus are beneficial to prevent muscle retraction of the pretarsal eyelid.
- Cut the fixation suture knots as short as possible and bury them deeply to prevent suture spitting out.
- The skin-pretarsal fascia-skin maneuver in incision closure is an additional assurance to form reliable adhesion.

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Compliance with Ethical Standards

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

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