



Small-Incisional Double Eyelid Blepharoplasty: A Retrospective Study of Our Minimally Invasive Technique with Three Mini Incisions



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Abstract

Background Small-incisional double eyelid surgery has been increasingly performed these years and achieved good aesthetic results, but the techniques vary greatly between literatures. The authors reviewed the cases of three-small-incisional double eyelid surgery performed in the past three years and introduced their surgical technique in detail.

Methods A total of 87 patients receiving bilateral three-small-incisional double eyelid surgery were included in this retrospective study. The pretarsal folds were designed meticulously, along which three evenly distributed 2 mm-long incisions were made. A minimal amount of orbicularis oculi muscle and pretarsal soft tissue were removed to expose the pretarsal fascia for further fixation. An appropriate amount of orbital septal fat was removed through the lateral incision if required. The superficial orbicularis oculi muscle and dermis on the lower margin of the incision were fixed onto the pretarsal fascia with some underlying tarsus on the upper margin of the tarsus. The skin was closed by one stitch for each incision.

Results The average follow-up was 9.9 ± 5.2 months (range: 6–27 months). All the patients were satisfied with the result. None of them experienced loss of the pretarsal

fold, bilateral asymmetry, scar hyperplasia, or persistent swelling after surgery.

Conclusions Our three-small-incisional technique with minor soft tissue debulking offers a simple, safe, and reproducible approach to double eyelids. It can create a stable and natural-looking pretarsal fold with a short recovery period.

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 Double eyelids · Small-incisional blepharoplasty · Soft-tissue debulking · Pretarsal fixation

Introduction

Nearly half of the Asians have single eyelids [1], which are anatomically characterized with a soft tissue redundancy and a lack of levator expansion into the dermis. Double eyelids can be surgically created by removing the excessive soft tissue and creating an attachment between the skin and the levator aponeurosis (LA), so that a pretarsal fold can be formed when the levator pulls open the eyelid [2].

The mainstream techniques of double eyelid surgery can be classified into the suturing technique (also named as the non-incisional technique) and the full-incisional technique. For patients without skin laxity and subcutaneous tissue redundancy, the suturing technique can be performed to bury a non-absorbable suture under the skin. The tarsus and the orbicularis oculi muscle (OOM) are tied up together by the suture to form an adhesion, and therefore, a double eyelid can be formed when opening eyes. Because no tissue

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is removed, the trauma to the upper eyelid is limited, and the post-op recovery is considerably fast. However, with repeated movement of the upper eyelids, there is a high chance that the suture detaches from the OOM or tarsus, leading to a rate of pretarsal fold-loss as high as 19.3% [3]. For patients with loose upper eyelid skin and excessive pretarsal soft tissue, the full-incisional technique must be used. This technique allows for (1) adequate soft tissue debulking, including removal of the flabby skin, the hypertrophic OOM, the bloated retro-orbicularis oculi fat (ROOF) and the excessive orbital septal fat (OSF), (2) accurate strength adjustment of the levator muscle to correct various degrees of blepharoptosis [4], and (3) exact pretarsal fixation under direct vision. The pretarsal adhesion formed in this way is stronger, but the post-op recovery period is much longer with a certain risk of scar formation [5].

Either the high rate of fold-loss after the suturing technique or the long recovery time after the full-incisional technique makes numbers of patients hesitate to accept a double eyelid surgery. With the gradual implementation of the concept of minimally invasive surgery, minimally invasive double eyelid surgery has become a common surgical procedure from an attempt. In 2001, Yang et al. published the first article on double eyelid surgery with one single small incision. Through a 4 mm-long skin incision in the middle of the upper eyelid, the OSF was removed as appropriate, and the pretarsal fixation was clearly performed. The final double eyelid morphology was natural with an average fold-loss rate of 3.9% [6]. Subsequently, the small-incisional double eyelid surgery, including single-incisional, double-incisional, three-incisional, and four-incisional techniques, have increasingly been reported [7–16]. Among them, the three-incisional double eyelid surgery is most widely performed, and gradually becomes the mainstream of small-incisional double eyelid surgery [17].

In a three-incisional blepharoplasty, the three mini incisions are usually evenly distributed between the medial and lateral canthi, with a length of 2–3 mm for each incision. But the debulking method and the pretarsal tissue fixation vary greatly between literatures [11–16]. As far as the authors' clinical experience is concerned, radical soft tissue removal through small incisions may do more harm than good. As long as the surgical indications are mastered, minor soft tissue removal can achieve a good surgical result. Here, the authors review the cases of three-small-incisional double eyelid surgery performed in the past three years and introduce our surgical technique in detail.

Methods

This is a retrospective study including 87 patients receiving bilateral three-small-incisional double eyelid surgery by the same senior surgeon. Before the surgery, all the patients were informed in detail about the complications, including hematoma, wound infection, scarring, loss of the pretarsal fold, and asymmetry of the bilateral folds. All the patients signed the informed consent for the surgery and for the non-commercial use of their images.

Patient Selection

Patients selected for this technique must meet all the following criteria: (1) with single eyelids or unaesthetic double eyelids, (2) with no or minor upper eyelid skin laxity, (3) with no hypertrophy of ROOF and OOM, (3) with no or minor accumulation of OSF, (4) with no lacrimal gland prolapse, (5) with no or minor blepharoptosis.

Fold Designing

Before surgery, patients were taken photos in a standing or sitting position. They were asked to hold a mirror in front of one of the eyes and in this way to participate in the fold designing procedure. A double eyelid was primarily designed with a shaped clip lifting the central upper skin (Fig. 1). The shape and width of the pretarsal show can be adjusted by moving the clip, until the decision was made by the patient and the surgeon together. Generally, the suggested double eyelid incision on the midpupillary line is 6–8 mm away from the upper eyelid margin for Asian female, and 5–7 mm for Asian male.

After the primary designing, the patient was in a supine position to receive the surgery. After facial disinfection with 75% alcohol and sterile draping, the fold was designed and drawn using a toothpick dipped with methylthionine chloride. The patient was asked to open the eyes naturally.



Fig. 1 The double eyelids were designed with a shaped clip gently lifting the central upper skin when the patient was in a sitting or standing position

The medial corneal line, the midpupillary line, the lateral corneal line, and the lateral vertical line 1 mm medial to the lateral canthus were subsequently marked. Then the patient was asked to close the eyes relaxedly. The pretarsal skin was gently stretched by lifting the eyebrow until the eyelashes were just about to be upturned. The widest position of the pretarsal fold was marked respectively as point B on the midpupillary line, point C on the lateral corneal margin, and point D on the lateral vertical line. This width was determined by the surgeon and the patient together during the primary designing when the patient in a standing/sitting position. The patient was again asked to open the eyes when a tweezer was put at point B to simulate the pretarsal fold. The medial width was determined by the spontaneous skin stretching and was marked as point A 2 mm medial to the medial corneal margin. A curve line was drawn to connect these four marking points smoothly. The patient was asked to open the eyes again with a tweezer to reconfirm all marking points were on the designed fold (Figs. 2, 3).

Skin Incisions

Three mini incisions were marked on the designed line. The medial one was made medially from point A (Incision a), the central one was made medially from point B (Incision b), and the lateral one was made laterally from point D (Incision c). Each incision was 2 mm-long (Figs. 2, 3).

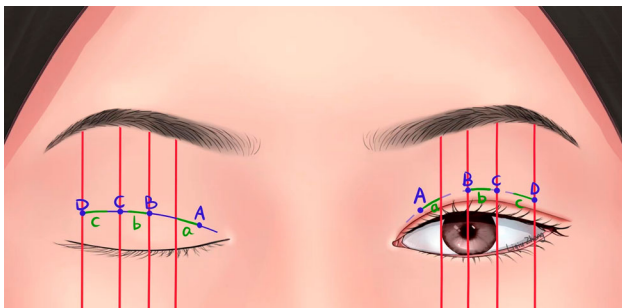


Fig. 2 The medial corneal line, the midpupillary line, the lateral corneal line, and the vertical line 1 mm medial to the lateral canthus were subsequently marked when the patient opened eyes naturally. Point B was marked on the midpupillary line, point C was marked on the lateral corneal margin, and point D on the lateral vertical line when the patient closed eyes. The width from the upper palpebral margin to these three points was the same and was determined during the primary designing. Point A was 2 mm medial to the medial corneal line and was just on the pretarsal fold when the patient opened eyes with a tweezer put at point B. A curve line was made by connecting these four marking points. Three incisions at a length of 2 mm were made. Incision a was made from the medial corneal line to point A. Incision b was made laterally from point B. Incision c was made medially from point D



Fig. 3 Three mini incisions shown on a patient when opening (a) and closing (b) eyes

The formulation of local anesthetics was 5 mL of 2% lidocaine + 5 mL of 0.75% ropivacaine + 0.1 mL of 1% epinephrine. The local infiltration anesthesia was performed under each incision with a 30 G needle and 1 mL syringe. For each incision, 0.2–0.3 mL of anesthetics was infiltrated. Wait 10 minutes for the vasoconstriction effect of epinephrine. The full-thickness skin incisions were made along the marked incision lines by a No. 11 sharp scalpel.

Soft Tissue Debulking

Sharp dissection of the subcutaneous area was performed with ophthalmic micro-instruments. The OOM of 2 mm-long and 1 mm-wide under each incision was pinched up by ophthalmic forceps and was cut by ophthalmic scissors. In the same way, a small amount of pretarsal soft tissue was removed to expose the underlying pretarsal fascia for further fixation. As we regularly waited 10 min for the vasoconstriction effect of epinephrine, the bleeding during skin incision and soft tissue debulking was minimal, and we hardly had the chance to use an electrocoagulation pen for hemostasis during this procedure.

Whether to remove the OSF and the amount of removal were evaluated before surgery when the patient was in a standing or sitting position. OSF was removed as appropriate through the lateral incision, as removal of the medial fat offers little cosmetic advantage and predisposes the patient to a sunken eyelid. The ophthalmic forceps was inserted upward and inward to pinch out the lateral side of the anterior orbital septum. During the process of pulling out, the slight sliding of OSF can be felt, which is different from the pulling of pretarsal aponeurosis. Through the lateral incision, the white septum structure can be easily distinguished from the underlying yellowish fat, and the boundary between the two structure is relatively clear



Fig. 4 A button-hole incision was made on the anterior orbital septum through the lateral mini incision (a). The orbital septal fat was pinched out (b), with a gentle squeeze on the top of the eyelid to facilitate fat herniation (c)

(Fig. 4a). This also helps to distinguish anterior orbital septum and pretarsal aponeurosis and avoid accidental cutting injury to the underlying pretarsal aponeurosis. The anterior orbital septum was kept being pinched and tightened, until a small button-hole incision was made by scissors (Fig. 4a). The underlying OSF was pinched out with a gentle squeeze on the top of the eyelid facilitating the fat herniation (Fig. 4). After being infiltrated with 0.1 mL of local anesthetics, the fat pedicle was clipped by a hemostatic forceps along which the upper part of the fat was removed, and the remaining fat pedicle was preventively coagulated by an ophthalmic electrocoagulation pen before releasing back due to the abundant vascular supply there.

From the outside in, a minimal amount of OOM, pretarsal soft tissue, anterior orbital septum of the lateral side, and an appropriate amount of OSF were subsequently removed (Fig. 5).



Fig. 5 The orbicularis oculi muscle (top), the pretarsal soft tissues (second row, mainly pretarsal fat tissues), lateral wall of the anterior orbital septum (third row), and the orbital septal fat (bottom) were successively and appropriately removed

Pretarsal Fixation and Skin Incision

A 7-0 nylon suture was used to transversely pass through the pretarsal fascia with some underlying tarsus on the upper margin of the tarsus, then vertically pass through the edge of the superficial OOM and dermis on the lower margin of the incision (Fig. 6). A slipknot was made temporarily. The patient was asked to open the eyes for shape confirmation. When both the surgeon and the patient were satisfied with the eyelid crease, the suture was exactly knotted and buried under the OOM. The first knot was gently fixed to avoid tissue necrosis, while the remaining knot was made tightly. Finally, the skin was closed using a 7-0 nylon suture. Each incision needed only one stitch. A thin layer of erythromycin ointment was applied to the incisions. If any bleeding was noticeable during the surgery, a gauze dressing with applicable pressure was applied to the upper eyelid, otherwise no dressings were necessary.

Post-op Care and Follow-ups

Ice packs can be applied to the upper eyelids to relieve the discomfort during the first 3 days after surgery. The incisions were cleaned by the patients using normal saline twice a day. The stitches were removed on the fifth post-op day. Spicy foods were contraindicated during the first month after surgery. All the patients were free to contact the authors using WeChat (Tencent Technology Co. Ltd, Shenzhen, China) in case of any post-op complications and queries. They were asked to get back to the hospital for follow-up assessments on the 3rd and 6th post-op months.

Results

All the patients were female with an average age of 24.2 ± 3.7 years (range: 18–32 years). They all kept contact with the authors through WeChat and were followed-up for at least 6 months. Among them, 63 patients completed the

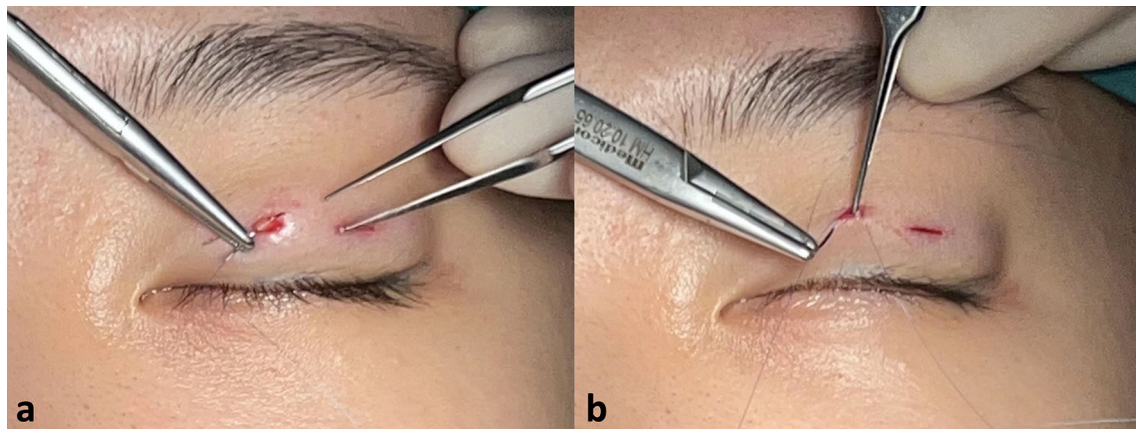


Fig. 6 The pretarsal fixation was achieved using a 7-0 nylon suture to transversely pass through the pretarsal fascia with some underlying tarsus (a) and then vertically passed through the edge of the superficial OOM and dermis on the lower margin of the incision (b)

3-month face-to-face follow-up, 48 patients completed the 6-month face-to-face follow-up, and were otherwise followed-up through a video-call on the WeChat. Some patients kept contact with the authors after the twice basic follow-ups. The average follow-up was 9.9 ± 5.2 months (range: 6–27 months). All the patients were satisfied with the result. None of them experienced loss of the pretarsal fold, and no patient contacted the authors due to bilateral asymmetry, local scar hyperplasia, and persistent swelling after surgery.

Figure 7 presented a 25-year-old female complaining of the unaesthetic single eyelids. The skin was slightly flaccid, and the upper eyelids were slightly puffy (Fig. 7a, b). Palpation manifested minor redundancy of the OSF. Considering the patient's demand of short recovery time and natural aesthetic effect, the small-incisional technique with three mini incisions was performed. A strip of 2 mm-long and 1 mm-wide OMM and pretarsal soft tissue were removed under each skin incision. The lateral wall of the anterior orbital septum was cut open through the lateral

incision and an appropriate amount of the OSF were removed. The patient was satisfactory with the stable and natural-looking pretarsal show (Fig. 7c). The medial scar is relatively more obvious than the central and lateral ones when closing eyes, since the skin above was not removed, causing a skin fold above the incision instead of a scar (Fig. 7d). This is also a limitation of using small-incisional technique for patients with mild skin laxity and epicanthus.

Figure 8 presents a 24-year-old female with narrow congenital double eyelids before blepharoplasty (Fig. 8a, b). The patient thought her natural eyes were listless and wished for wider double eyelids. The upper eyelid skin was thin with good elasticity. There was no soft tissue redundancy, ptosis, or lacrimal gland prolapse. Therefore, a three-small-incisional technique was suggested and performed. The patient was satisfactory with the result (Fig. 8c) and the skin incisions were noteless 6 months after surgery (Fig. 8d).

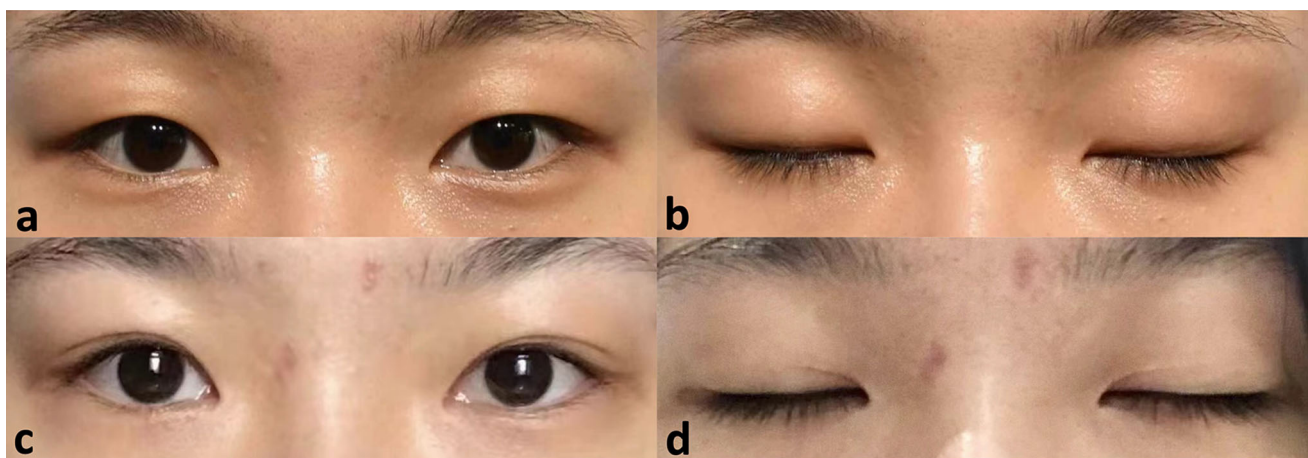


Fig. 7 A 25-year-old female patient before surgery (a, b), and 6 months after surgery (c, d)



Fig. 8 A 24-year-old female patient before surgery (a, b), and 6 months after surgery (c, d)

Discussion

As we have reported in the latest systematic review regarding small-incisional blepharoplasty [17], the single-incisional technique was firstly described in 2001, the two- and three-incisional techniques were successively reported since 2010 and 2011, and the four-incisional technique was reported only once in 2016. Among all the small-incisional blepharoplasty, three-incisional surgery has now become the mainstream, largely because the equally distributed skin incisions and deep adhesions are more likely to form a stable and dynamically natural upper eyelid crease. On the contrary, the crease formed in a single-incisional surgery is prone to sag on bilateral ends. The single incision and the consequent local scarring dent are much longer, ranging from 4 to 15 mm [17], than those required in a multi-incisional surgery. Two-incision is not as good at handling the lateral side as three-incision, while four-incision has not yet reflected its necessity.

The reported technique of three-incisional blepharoplasty is not exactly the same (Table 1). In early reports, the surgeons preferred to perform an extensive dissection to form a subcutaneous cavity through the small incisions and resect a full-length of pretarsal OOM and pretarsal fat tissues [11–14]. This approach has certain drawbacks: (1) The radical dissection and removal of the pretarsal tissue inevitably causes bleedings, which is difficult to coagulate exactly through small incisions. The post-op hematoma can be obvious [7], and the surgeon even had to extend the small incision for better hemostasis. (2) Except for the remaining of two skin bridges between each incision, the radical soft tissue debulking as well as the resulting vascular and lymphatic disturbances can be comparative with that in a full-incisional blepharoplasty, causing a long post-op recovery period and significant edema [12]. (3) Removal of large amount of subcutaneous tissue without

skin removal can easily cause obvious depressed scars in front of the tarsus [13].

As the surgeons' understanding of small-incisional techniques progresses, the amount of tissue removal has been decreased in the recent two studies [15, 16]. In Liu's study, the distribution of the three small incisions were not introduced, the OOM and pretarsal soft tissues were appropriately removed, and no OSF was removed [15]. In Chen's study, no pretarsal tissue was removed, the OOM was dissected in a spreading manner to expose the LA on the upper margin of the tarsus for further pretarsal fixation [16]. The complete preservation of the OOM and pretarsal tissue may lead to unstable adhesion in front of the tarsus, possibly leading to a fold-loss. Moreover, the patient images displayed in Chen's study were taken 2 weeks and 2 months after surgery, making it difficult to demonstrate the long-term effects of their technique.

Different from previous studies [11–14], we believe that radical debulking through three small incisions has similar tissue damage and post-op recovery as full-incisional blepharoplasty does, and that the goal of the debulking procedure is to facilitate a stable connection between the deep tarsus and the superficial skin. Therefore, we removed only a 2 mm × 1 mm strip of OOM and pretarsal soft tissue under each incision, just in order to expose the underlying pretarsal fascia for further fixation. The minimal surgical trauma causes a slight post-op reaction and a rapid recovery. The even distribution of skin incisions and the underlying adhesion is secure enough to create a permanent upper eyelid crease.

After soft tissue debulking, a proper fixation between the deep motor system and the superficial tissue is another important procedure for fold stabilization. The LA, the pretarsal fascia, and the tarsus together are regarded as a linked dynamic motor system to form a double eyelid [18], and therefore any one or a combination of them can be

Table 1 Comparison between previous literatures regarding three-incisional double-eyelid surgery and our technique

References	Number of patients	Age (years)	Incisions (length and location)	Debulking method	Pretarsal fixation	Skin closure	Follow-up (months)	Complications
Bi [11]	90	23.4 (16–27)	2 mm each	A deep layer of pretarsal OOM was removed. The pretarsal fat tissue was removed. OSF was removed from the central and lateral incisions	Superficial OOM was fixed onto the LA, with a 6-0 nylon	Without suture	14–30	Fold loss (3.3%), asymmetry (5.6%)
Zhang [12]	110	23.4 (17–35)	3–4 mm each. Medial: 5 mm lateral to medial canthus. Central: at midpupillary line. Lateral: near lateral canthus	1/2 to 2/3 of OOM was removed. OSF was removed from the lateral incision	Lower and upper skin margin were fixed onto the pretarsal fascia, with a 5-0 silk thread	Without suture	3–12	Fold loss (4.5%), multiple folds (2.7%)
Zhou, 2014 [13]	396	21 (18–32)	3–4 mm each. Medial: near medial canthus. Central: at midpupillary line. Lateral: near lateral canthus	The whole strip of pretarsal OOM and pretarsal fat tissue were removed. OSF was removed from the lateral incision	Lower and upper skin margin were fixed onto the pretarsal fascia, with a 6-0 silk thread	Without suture	6–36	Fold loss (0.8%), asymmetry (0.8%), scar (0.5%), unaesthetic fold (1.0%)
Zhang [14]	80	25.6 (18–35)	2 mm each	A deep layer of pretarsal OOM was removed. The pretarsal fat tissue was removed. OSF was removed from the central and lateral incisions	Superficial OOM was fixed onto the LA	Without suture	16–24	Fold loss (6.3%)
Liu [15]	24	24.6 (21–28)	2–3 mm each	The OOM and pretarsal soft tissues were appropriately removed. No OSF was removed	Superficial OOM was fixed onto the tarsus, with a 6-0 Prolene	7-0 absorbable suture	12–34	0
Chen [16]	132	27 (18–48)	2 mm each. Medial: middle of medial corneal margin and medial canthus. Central: pupil. Lateral: middle of lateral corneal margin and lateral canthus	No pretarsal tissue was removed (The OOM was dissected only to expose the LA for fixation). OSF was removed from the lateral incision	OOM was fixed onto the LA, with a 7-0 nylon suture	7-0 nylon suture	6–24	Fold loss (0.8%), asymmetry (4.5%), unsatisfactory (2.3%)
Ours	87	24 (18–32)	2 mm each. Medial: laterally from the medial corneal margin. Central: medially from the midpupillary line. Lateral: laterally from the line 1 mm medial to the lateral canthus	A 2 mm × 1 mm strip of OOM and pretarsal soft tissue beneath the incisions were removed. OSF was removed from the lateral incision	Superficial OOM and dermis was fixed onto the LA, with a 7-0 nylon suture	7-0 nylon suture	6–27	0

*OOM orbicularis oculi muscle, OSF orbital septal fat, LA levator aponeurosis

chosen as the anchor of the pretarsal fixation [19–21]. As for the superficial tissue chosen for fixation, Sayoc suggested a surgical linkage between the dermis and the deep motor system based on his anatomical finding that the superficial LA inserted into the pretarsal dermis in double eyelids [22]; while Morikawa and colleagues suggested a surgical linkage between the superficial OOM and the deep structure, as they found the insertion fiber of LA was continuous with the subcutaneous tissue instead of the skin under an electron microscope [23]. Various fixation methods have been reported and there are neither principled errors nor absolute advantage or disadvantage between them [17]. For a stable fixation and a dynamic double eyelid, the authors prefer to fix the dermis and the superficial OOM together onto the pretarsal fascia with some underlying tarsus on the upper margin of the tarsus.

Besides a proper surgical technique, appropriate patient selection is necessary to achieve excellent results. This is also the major limitation of our technique, which is limited to patients with good skin elasticity, and no or only minor upper eyelid skin laxity. Although large amount of redundant OOM, pretarsal fat, OSF can also be removed through small incisions as some literatures suggested, it is not recommended here because of the long recovery time and the obvious depressed scar. In patients requiring considerable soft tissue removal, we suggest a full-incisional blepharoplasty.

Conclusions

Our small-incisional blepharoplasty with three mini incisions, minor soft tissue debulking, and evenly distributed pretarsal fixations offers a simple, safe, and reproducible approach to create a stable and natural-looking pretarsal fold with a short recovery period. When the patient is properly selected, a good aesthetic result and a low complication rate can be achieved.

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Declarations

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Ethical Approval This is a retrospective clinical study. All the patients voluntarily came for the surgery and signed the informed consent with knowing the potential surgery-related risks and use of their images. An ethical approval was not applicable in this study.

Informed Consent All the patients signed the informed consent for surgery and for the non-commercial use of their images.

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