



# Supraciliary Incision as a New Double-Eyelid Approach for Asian Patients: Clinical Experience of 528 Cases

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Received: 10 April 2020 / Accepted: 9 June 2020 / Published online: 29 July 2020

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## Abstract

**Background** The double-eyelid operation is the most requested cosmetic surgery in Asians. The incision is usually located at the pretarsal skin 6 mm to 8 mm above palpebral margin. The purpose of this paper is to report a novel approach of double-eyelid operation through a supraciliary incision (SCI).

**Methods** Three transverse curved lines were drawn on the upper lid skin. The location of line 1 (SCI) was 1.5 mm above the eyelash, line 2 according to the amount of redundant skin excised and line 3 at 3 mm to 4 mm above line 2. After the incisions were made between line 1 and line 2, the subcutaneous dissection is carried out over 5 mm the line 3. Then, the redundant skin and a strip orbicularis oculi muscle were removed to open the orbital septum and to explore underside levator aponeurosis. Along the line 3, the internal buried fixation sutures between dermal tissue and the fusion line of the orbital septum and levator aponeurosis were placed. Finally, the wounds were closed between line 2 and line 1.

**Results** There were 528 patients who underwent the double-eyelid operation through the supraciliary approach. In long-term follow-up, 288 patients were evaluated at 6 months to 78 months postoperatively. Of those, 266 patients were satisfactory for the result (92.36%) with

natural shape and invisible surgical scar. In another 22 patients (7.63%), a revised blepharoplasty was performed in 22 eyelids.

**Conclusion** The double-eyelid surgery using the SCI has several advantages including less visibility of the incision, the protected subdermal vascular network, the intact continuity of the upper eyelid skin, the combination of the SCI and internal dermal buried suture method. The approach can be considered an efficient technique for Asian patients. **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](http://www.springer.com/00266).

**Keywords** Blepharoplasty · Double-eyelid surgery · Supraciliary incision

## Introduction

Lack of a supratarsal fold is one of the characteristic appearances of East Asian person's eyelids. The reason is no fibrous connection between the eyelid skin dermis and the levator aponeurosis and an abundance OF preseptal and preaponeurotic fat [1–4]. The inferior extension of the orbital septum and preaponeurotic fat also play a barrier role resulting in an ill-defined or absent crease. Various appropriate surgical techniques with advantages in creation, control and longevity to manipulate the supratarsal crease have been recommended in Orientals.

There are two surgical procedures, incision and non-incision methods, for forming a double-eyelid fold at present. In the incision technique, the incision is usually placed at the supratarsal skin, about 6 mm to 8 mm from

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s00266-020-01838-4>) contains supplementary material, which is available to authorized users.

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the palpebral margin. As a result, the obvious incision scar and long-lasting edema during recovery still are the main reasons of hesitation for surgery in some patients. The invisible surgical trace and fast recovery after surgery are the most elementary requests for patients. In the non-incision method, the buried suture technique is a conventional method without visible scar and has a faster recovery. Its disadvantage is that it is not suitable for patients with weakened levator strength, redundant skin or fat bulge in the upper eyelid.

In this paper, we present an innovative surgical approach, which is combined with the two methods mentioned above, for double-eyelid blepharoplasty. The appropriate combination of the supraciliary incision (SCI) to create an invisible surgical scarring and the internal buried sutures between the dermis and the levator aponeurosis to achieve a definite natural supratarsal crease is introduced.

## Materials and Methods

### Patients

During the past 10 years, from January 2007 to June 2017, we used this SCI double-eyelid operation in 528 cases. Among these patients, 521 were female and 7 were male. The ages of these patients ranged from 17 to 45 years. All of the patients had relatively normal upper eyelid structures. There were 452 patients who underwent SCI blepharoplasty with epicanthoplasty using the redraping method simultaneously [5].

### Surgical Procedure

#### *Preoperative Preparation*

Before the operative design, the patient's face is cleared. A blood test is taken and premedication with antibiotics (cephalexin, 500 mg) is given 30 min prior to the procedure.

During the clinical examination, the static and dynamic state of the patient's eyelids is observed carefully and the degree of upper eyelid skin relaxation in the upright position should be recorded in detail. Abnormal levator muscle function should be checked out. After fully understanding of the patient's desire, the appearance of the double eyelid is recommended.

#### *Surgical Design*

When designing, the upper eyelid skin must be stretched slightly. The lines should be extended from medially to

laterally along the palpebral fissure, parallel to the tarsal margin. Crease height is checked in the upright and supine positions.

Firstly, the lower incision line, supraciliary incision (SCI) line, is placed at about 1.5 mm above the eyelash margin, which is drawn parallel to the curvilinear shape of the eyes. Secondly, according to the sagging degree of eyelid skin which should be excised, the upper incision line is placed about 2.0 mm to 5.0 mm from the lower incision line and parallel with it. This line tapers from middle to lateral and medial canthus and connects with the superciliary incision line. In Asians, there is often redundant eyelid skin which is going to fold over the new crease, especially in patients more than 30 years old. It means that the narrow strip of skin in the upper eyelid is usually marked for redundant skin excision. Thirdly, the crease fixed line (non-incision) is located about 4.0 mm to 5.0 mm higher than the upper incision line, where is the fixing position of subdermal buried suture for creating a double eyelid. Finally, three to five vertical lines are marked at the points of mid-pupil, lateral margin of corneal in equal distance and cross above three transverse lines (Fig. 1a). All the marks should be reconfirmed with 1.5% iodine solution or drawn again after skin sterilization.

#### *Incision and Dissection*

Operations are performed under local anesthesia. Lidocaine (2%) with 1:100,000 epinephrine is infiltrated to the subdermal layer with a 30-gauge needle (Fig. 1b). The crease fixed line is pricked with a fine needle and methylene blue (Fig. 1c). A no. 11 scalpel blade or a fine-tipped iris ophthalmic scissors is used to make incisions deep to the subdermal layer. The subcutaneous dissection is carried out between the lower incision line and the crease fixed line (Fig. 1d). The subcutaneous dissection is extended up to 3 to 5 mm above the crease fixed line by protecting the subdermal vascular network, and the orbicularis oculi muscle (OOM) is exposed (Fig. 1e). After the subcutaneous dissection is completed, the strip of skin between the lower and upper incision lines is excised using sharp curved scissors (Fig. 1f). Coagulation with a fine-tipped bipolar forceps often helps the operation. The skin of the upper eyelid is then stretched open with a retractor to reveal the OOM underneath (Fig. 1g).

#### *Crease Localization*

According to the designed height of the suprapalpebral crease, a strip of OOM about 2 mm width is removed horizontally under the preferred crease fixed line (Fig. 1h). The pretarsal OOM between the eyelash margin skin incision and the designed height of double eyelid (4 to

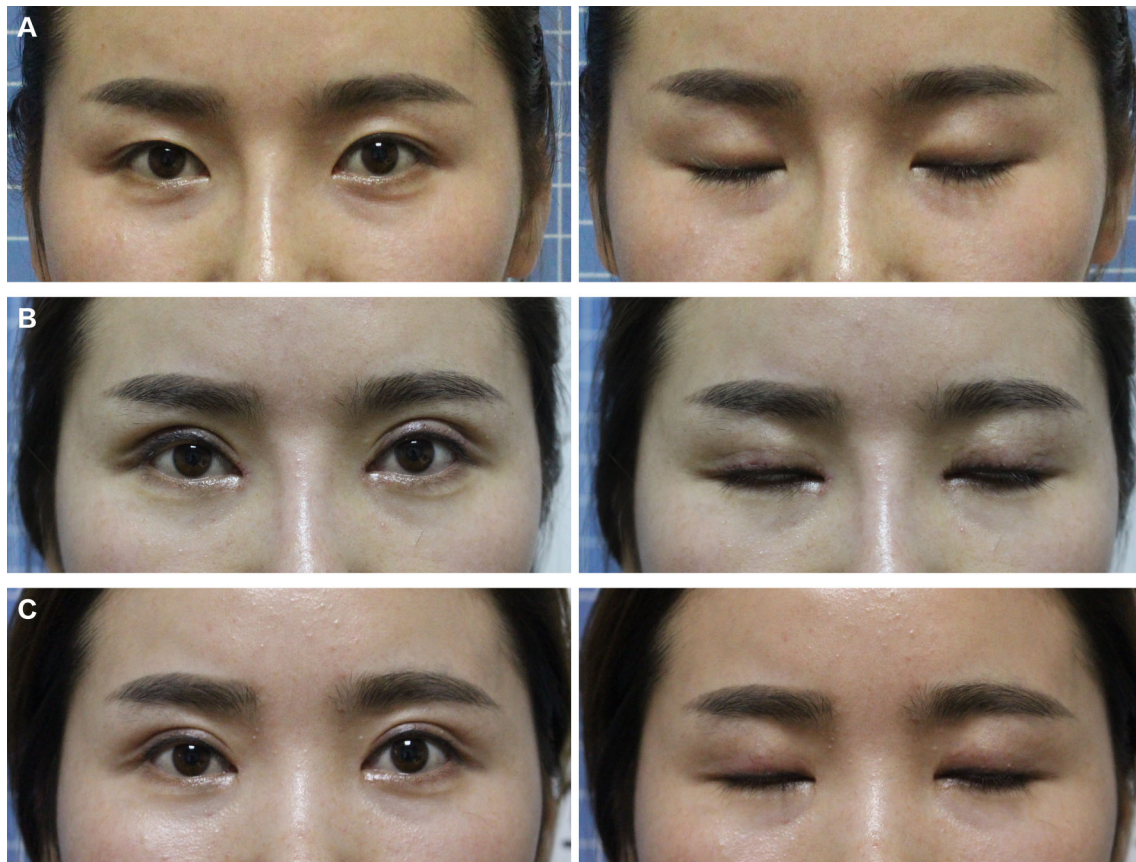


**Fig. 1** Surgical procedure of SCI double-eyelid operation. **a** Design of SCI double-eyelid operation. **b** Injecting local anesthetic. **c** Marking the crease fixed line with 27G needle. **d** Making the skin incisions and subcutaneous dissection. **e** Extending the subcutaneous dissection above the crease fixed line. **f** Excising the redundant skin of upper eyelid. **g** Exposing the OOM. **h** Removing a strip of OOM under the crease fixed line. **i** Retaining the pretarsal OOM. **j** Opening the orbital septum. **k** Identifying the levator aponeurosis. **l** Completely revealing the levator aponeurosis. **m** Showing the fusion region of levator

aponeurosis and orbital septum. **n** Passing the buried fixation stitches at the dermis in the needle-pricked crease fixed line. **o** Suturing the fusion line of the orbital septum and levator aponeurosis. **p** Taking subdermal buried fixation sutures laterally. **q** Anchoring subdermal buried fixation sutures medially. **r** Placing additional buried fixation sutures between the pretarsal OOM and flipped orbital septum. **s** Closing the incision by interrupted sutures. **t** The immediate double-eyelid appearance postoperatively

6 mm) should be retained in its primary anatomic position (Fig. 1i). It means that the pretarsal OOM extends about 3 to 5 mm beyond the lower incision line. The location of the OOM removal is very important because it is the subdermal fixed position with the crease fixed line at upper eyelid skin. The level and orientation of its location determine the future shape and height of the double eyelid. After the orbicularis muscle removal, a loose space between the preaponeurotic fat and the septum is revealed and the orbital septum becomes visible as dissection. The levator

aponeurosis is just underneath the orbital fat compartment. After opening the orbital septum using a fine-tipped scissors (Fig. 1j), which should be placed 3 mm to 4 mm above the fusion line between the orbital septum and the levator aponeurosis superior to the muscle incision, it is easy to get into the preaponeurotic fat space and part of the orbital septum fat could be released and repositioned or removed. The preaponeurotic tissue and the entire levator aponeurosis as a glistening membrane distinguishable from the orbital septum are exposed after dividing the orbital



**Fig. 2** Preoperative view of a 30-years-old single-eyelid woman with eyes open (left column) and with eyes closed (right column) (a), who underwent the SCI double-eyelid surgery technique and epicanthoplasty. Photographs 1 week after suture removal (b). One month

postoperatively, the patient is exhibiting less edema in eyelids, which is characterized by a natural depth of the fold with invisible surgical scar (c)

septum laterally and medially (Fig. 1k). To reveal the levator aponeurosis completely is a key to the success of the appreciated double-eyelid formation (Fig. 1l).

The partial anterior orbital septum is flipped downward and forwarded with superficial expansion (anterior layer) of the levator aponeurosis to compose the pretarsal OOM and subdermal extension of levator aponeurosis. This is one of the important components of the natural double-eyelid formation in the upper eyelid dynamic system.

#### *Crease Formation*

The skin of the upper incision is stretched open with a retractor to reveal the subdermal tissue of the crease fixed line and the fusion region of levator aponeurosis underneath (Fig. 1m). According to the elasticity of the upper eyelid skin, the distance between the crease fixed line and upper incision line plus 1.5 mm above the eyelash is identified equal to the designed height of suprapalpebral crease. Then, internal subdermal buried 8–0 nylon sutures are placed to anchor the dermis at the needle-pricked

crease fixed line (Fig. 1n) to the fusion line of the orbital septum and levator aponeurosis, allowing the knot to be buried (Fig. 1o). Four to six internal subdermal buried sutures along the crease fixed line are taken in the mid-pupillary, peri-corneal positions and near the lateral and medial canthal areas (Fig. 1p, q).

During the crease formation, the flipped septum and extension of the levator aponeurosis also can be anchored with the superior edge of the pretarsal OOM using interrupted subdermal sutures (Fig. 1r) for getting more natural eyelid movement. These added procedures help to accomplish the anatomical structure of the supratarsal crease, to regain the terminal dynamic transfer system of the levator and to create a natural and beautiful double eyelid.

After fixation, there is a shallow groove in the upper lid skin due to the pull of the dermal–levator aponeurosis fixation (Fig. 1r). The corrective position of the internal buried sutures is the key point for the successful double-eyelid formation.

Once the internal subdermal fixed sutures are completed, the patient is asked to open and close the eyes. The reliability of the dermal suture fixation should be evaluated, and the shape and symmetry of created double-eyelid should be adjusted through the position of dermal buried sutures and confirmed in upright position. Any problems including levator strength weakness, disinsertion or dehiscence of the levator aponeurosis, lacrimal gland ptosis, sunken eyelid and eyelid puffiness caused by submuscular or orbital fat should be corrected before the crease formation through the same incision.

#### *Incision Closure*

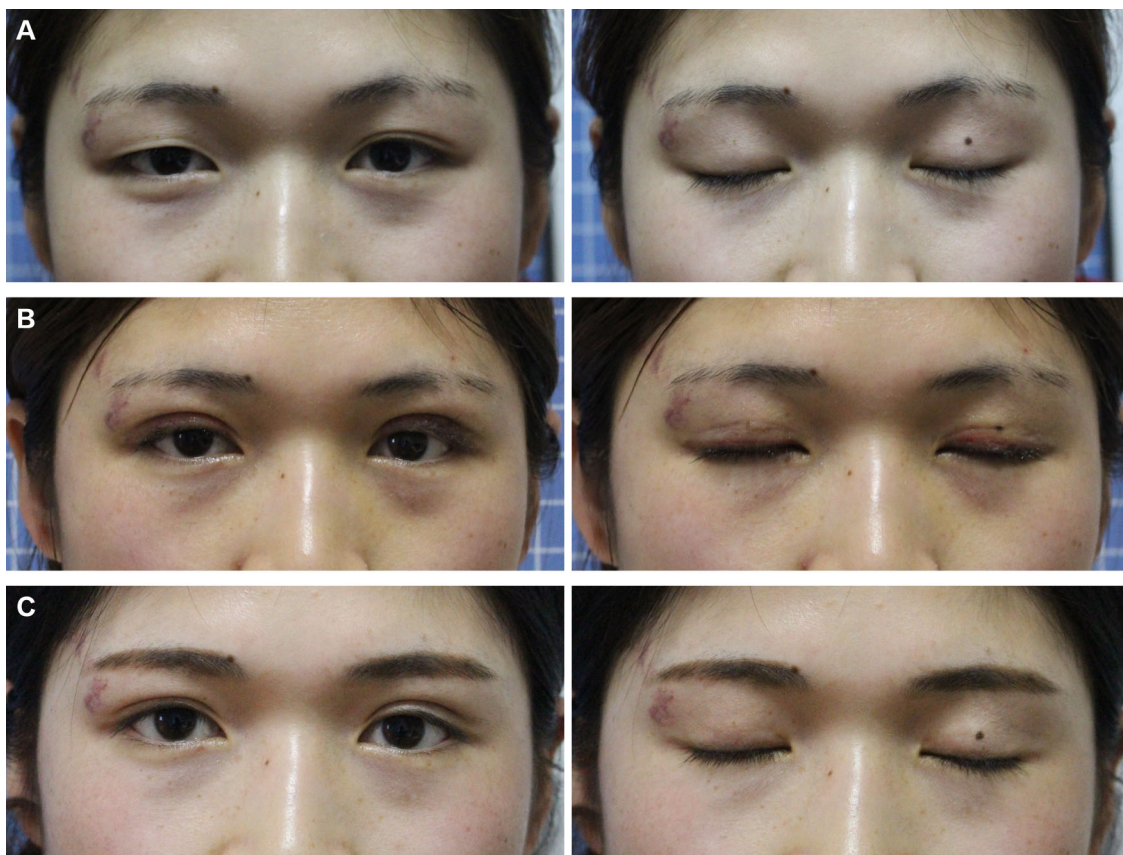
The incision was closed with interrupted 8–0 nylon sutures taken through the upper skin edge and the SCI (Fig. 1s). The surgeon should make sure that the appreciated eyelashes upward could be presented if lash ptosis was found preoperatively and ectropion of the palpebral margin should be avoided. Eyelash direction can be adjusted by the incision closure tension. Figure 1t demonstrates the immediate postoperative double-eyelid appearance of the patient.

## Results

All 528 patients were visited by telephone over 1 month after surgery without hematoma and wound healing problems and immediate complications. The edema recovery of the upper eyelid and the shape of eyelid folds were satisfactory in 461 patients (87.31%) (Fig. 2). There were no postoperative eye discomforts, such as dysfunction of the eyelid movement, dry eye and visual impact, mentioned by patients.

In long-term follow-up, 288 cases were evaluated at a visit (49.1%) ranging from 6 to 78 months (average, 9 months) (Figs. 3, 4, 5, 6, 7, 8, 9, 10 and 11). In 288 patients (576 eyelids), 266 patients were satisfactory for the result (92.36%) with natural shape and invisible surgical scar in 554 of 576 eyelids (96.18%).

The contours of the double eyelids were out-folded in the majority of patients (Figs. 2, 3, 4) with epicanthoplasty and in-folded in some patients (Fig. 5). The arc of the folds was smooth, natural and symmetric. The medial end of the fold often extended proximally to the corner of the medial canthus in patients with epicanthoplasty. The shapes of the eyelid fissures appeared attractive and open, and the



**Fig. 3** Preoperative view of a 20-years-old asymmetry eyelid fold woman with eyes open (left column) and with eyes closed (right column) (a), who underwent the SCI double-eyelid surgery technique.

Photographs 1 week after suture removal (b). Seven months postoperatively, the patient is exhibiting a dynamic upper eyelid fold with invisible surgical scar in supraciliary incisions (c)



**Fig. 4** Preoperative view of a 29-years-old single-eyelid woman with eyes open (left column) and with eyes closed (right column) (a), who underwent the SCI double-eyelid surgery technique and

epicanthoplasty. Photographs 1 week after suture removal (b). One year postoperatively, the patient is exhibiting a natural depth of the fold with invisible surgical scar (c)

appearance of the patients' eyes was improved. Scar proliferation of the incision was not present in all of the patients during the early postoperative period (Figs. 2, 5) and after complete recovery (approximately 2 to 6 months) (Figs. 3, 5, 9). During the observation of the eyelid movement, the folds were dynamic and natural when eyes were open and the creases were smooth and no over-depression when eyes were closed.

There is no disappearance of the folds with this procedure. All unsatisfactory problems appeared in unilateral eyelids in 22 patients, including too high crease in 14 eyelids (2.43%), the disappearance of the lateral partial double eyelid in 6 eyelids (1.04%) and multiple lines of upper eyelid in 2 eyelids (0.34%) postoperatively. Revised blepharoplasty was performed if the patients wish.

## Discussion

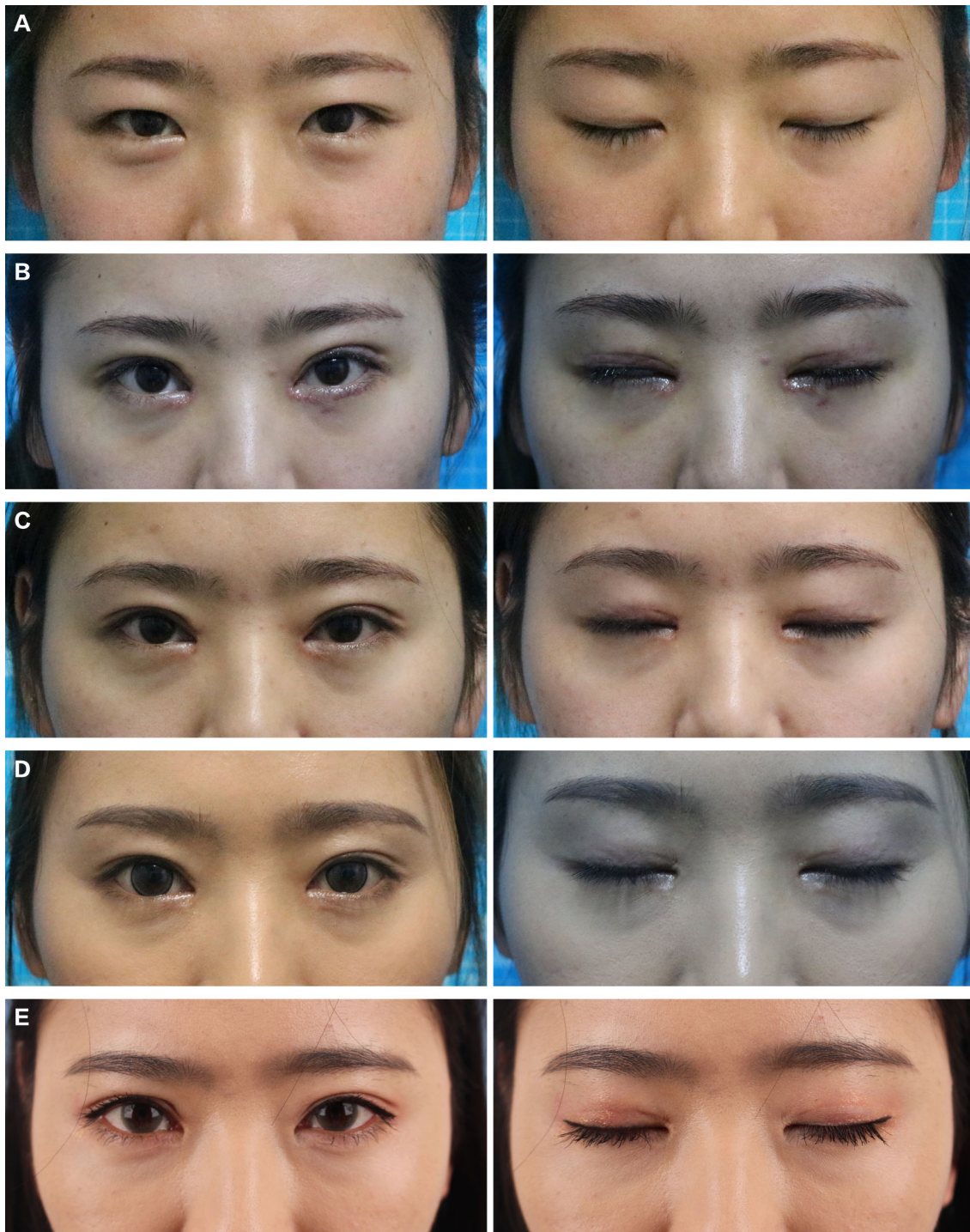
The double-eyelid surgery in the East Asian is the most common aesthetic operation. The incision for traditional double-eyelid surgery is designed 6 mm to 8 mm above the

palpebral margin of the upper eyelid skin, which often leaves visible surgical traces and inevitably causes aesthetically unpleasant scars in some Asian patients. It is one of the reasons that some patients hesitate to receive the double-eyelid operation. The SCI combined with the buried suture method for double-eyelid blepharoplasty has several advantages compared to the traditional incision method.

### Less Visible Surgical Scar

The clinical principles for scarless healing of incision wounds include right incision selection with Langer's lines, precise dissection with delicate instruments, less invasive surgical operation to soft tissue, adequate protection of vascular supply, careful and accuracy cautery and free tension closure of incision. Another often ignored factor contributing to scar formation is the thickness of the skin.

Because the dermal thickness and the content of collagen are higher in Asian facial skin compared with Caucasian skin, the potential for fibroblast overactivity exists and the possibility of hypertrophic scarring is increased in Asians [6, 7]. According to Lee's report, the dermal

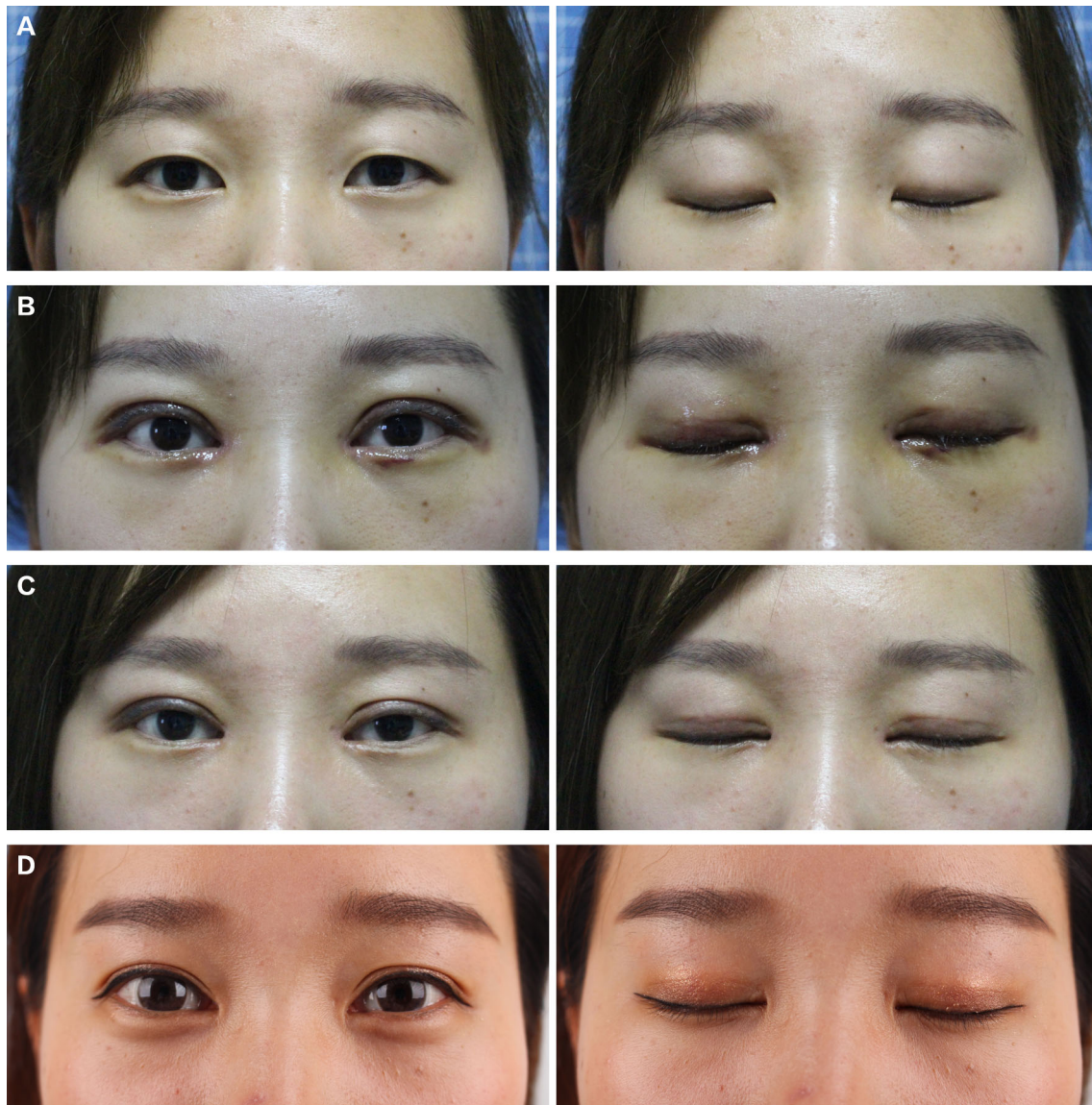


**Fig. 5** Preoperative view of a 25-years-old single-eyelid woman with eyes open (left column) and with eyes closed (right column) (**a**), who underwent the SCI double-eyelid surgery technique and epicanthoplasty. Photographs 1 week after suture removal (**b**). One month (**c**), 3

months (**d**) and 10 months (**e**) postoperatively, the patient is exhibiting less edema in eyelids, which is characterized by natural depth of the fold with invisible surgical scar (Video 1)

thickness of the eyelid is one of the thinnest regions in the body [8]. The other anatomic study revealed that the dermal thickness of the upper eyelid skin in the upper tarsal level was thicker than in the near ciliary margin by about

500  $\mu\text{m}$ . The upper eyelid was thinnest ( $320 \pm 49 \mu\text{m}$ ) near the ciliary margin [7] and with the smaller amount of elastic fibers than the thicker area [9]. Based on the study of Ince in 2015, the increased dermal thickness is a risk



**Fig. 6** Before and after photographs of a 29-years-old redundant upper eyelids female patient exhibiting a natural eyelid fold without a visibly depressed line using the SCI operation and epicanthoplasty after 5-mm-width skin removed (eye open in left column and eye

closed in right column). Preoperative views (a). Suture removal postoperative 1 week (b). Postoperative 2 weeks (c). Two years and 10 months postoperative views (d) (Video 2)

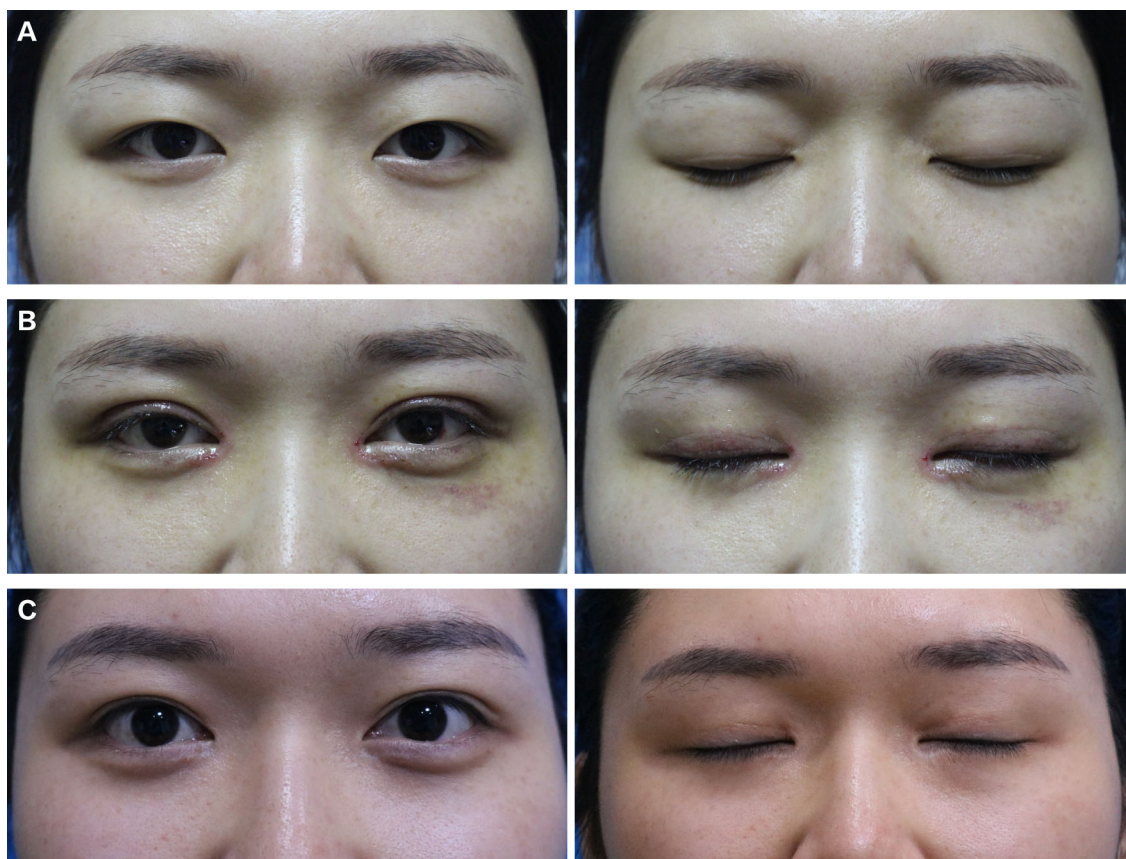
factor for wide scar formation [10]. It means that the hypertrophic tendencies of the incision scar may be minimized and the surgical scarring would be not obvious in thinner skin.

In our modified procedure, the incision is located at the supraciliary margin which results in a fine scar formation and there is no proliferation of the surgical incisions observed. It reveals that the pretarsal skin is only 0.3 mm to 0.5 mm thickness without subcutaneous fat between the skin and OOM [7] and presents less possibility to create a visible scar. We believe that the process of incision healing is different between the thinner and thicker skin. The thinner the skin incision places, the less obvious the

incision scar presents. This phenomenon is also confirmed in other surgical procedures related to the supraciliary and subciliary incision in medial epicanthoplasty [5, 11–14] and lower eyelid blepharoplasty. In our clinical observation, the healing of the supraciliary and subciliary incisions for blepharoplasty is obviously better than other surgical approaches.

For those reasons, the incision location for double-eyelid surgery is designed in the supraciliary region of the upper eyelid with thinner skin to reduce the surgical appearance and to get satisfactory scarless results in our series (Figs. 3, 4). The SCI approach used alone is also suitable for patients who have redundant skin in the upper eyelid, who





**Fig. 7** Before and after photographs of a 25-years-old redundant upper eyelids female patient exhibiting a natural eyelid fold without a visibly depressed line using the SCI operation and epicanthoplasty after 4-mm-width skin removed (eye open in left column and eye

closed in right column). Preoperative views (a). Suture removal postoperative 1 week (b). One and a half year postoperative views (c) (Video 3)

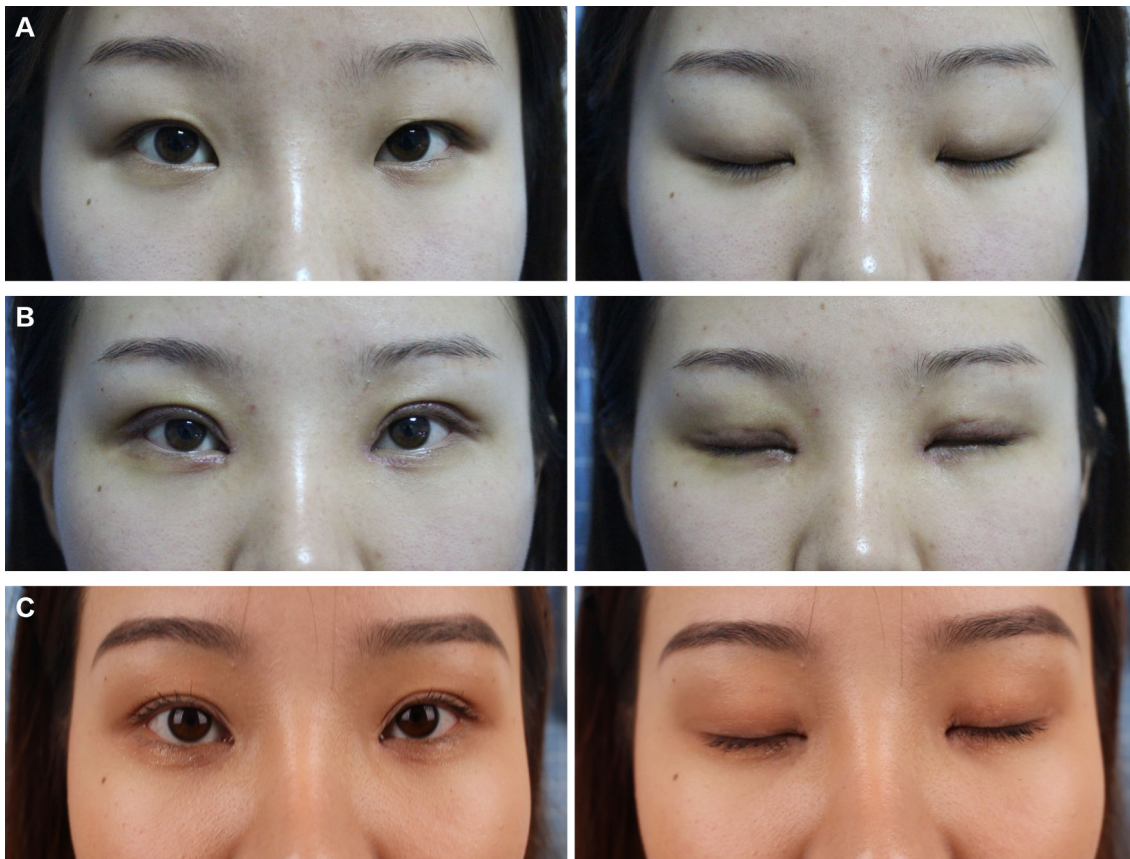
have a tattoo at the eyeline to be removed and who have a requirement to remove the suprapalpebral crease with invisible surgical scar. The SCI is also easily concealed by eyelashes.

### Quick Edema Subsiding

The long-term postoperative puffiness in pretarsal soft tissue is not an uncommon problem in double-eyelid surgery, which may result in an unnatural suprapalpebral crease appearance. Thicker skin, extensive surgery and older patients can have prolonged postoperative edema and sometime permanent puffiness. Injury of the vascular framework of the upper eyelid skin during blepharoplasty is one of the main reasons. An intact skin vascular architecture helps reduce those complications, but the subdermal vascular network of the upper eyelid skin was divided in the traditional incision double-eyelid operation. Even if it proved that the poor vascular connections between the dermal venous plexus have been considered to bring about venous congestion of the skin [15], the preservation of the venous network of skin and the superficial fascia of OOM,

including the subdermal vascular plexus with direct anastomosis, is beneficial to blood drainage during recovery.

The palpebral margin incision for double-eyelid surgery was reported in 2001 and has been applied by several Chinese plastic surgeons [16–21]. This surgical approach, called the SCI procedure by us, has also been used and modified in our Oriental eyelids since 2007. During the operation, the subdermal vascular plexus of the pretarsal and preseptal skin including the venous network in the superficial fascia of the OOM was observed and preserved in our technique (Fig. 12). In the traditional double-eyelid blepharoplasty, the subdermal vascular network was interrupted by incision. In our clinical follow-up patients, the postoperative edema subsided significantly faster than the traditional incision method (Fig. 2), and there was no permanent pretarsal tissue swelling and less surgical appearance (Fig. 5) (Video 1). There may be a relationship with good preservation of subdermal vascularization including the superficial fascia of OOM with the preorbicularis venous network (0.1 mm to 0.3 mm thickness) [22] and with completeness of blood drainage in the upper eyelid skin in our technique.



**Fig. 8** Before and after photographs of a 22-years-old single-eyelid female exhibiting a natural eyelid fold without a visibly depressed line using the SCI operation and epicanthoplasty (eye open in left

column and eye closed in right column). Preoperative views (a). Suture removal postoperative 1 week (b). One and a half year postoperative views (c) (Video 4)

### Favorable Natural Folds and Continuity

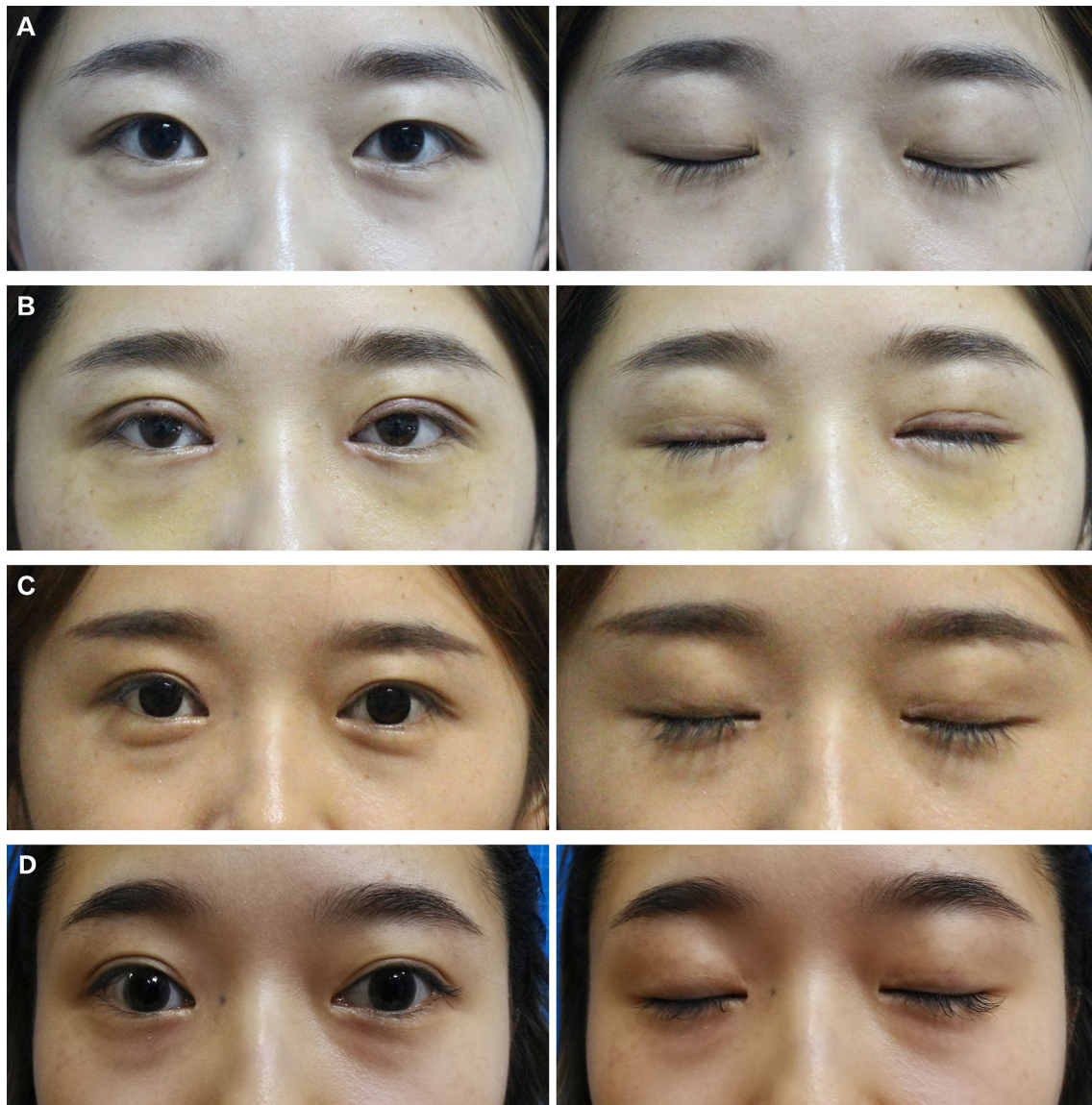
The natural appearance of the double eyelid is an essential requirement for the successful cosmetic outcome of upper blepharoplasty. A gradual and continual change of the thickness of the upper eyelid skin in the eyebrow–eye aesthetic unit would be presented as a natural supratarsal crease with light fold edge and the overlying fold curve during eyelid movement after the double-eyelid operation.

There are different thicknesses in the upper lid skin at different levels, from the thinnest pretarsal skin (0.3 mm to 0.5 mm) to the thinner preseptal skin (0.4 mm to 0.7 mm) and thick infrabrow skin (0.7 mm to 1.0 mm). It is thinnest near the ciliary margin and becomes thicker approaching the eyebrows. The natural suprapalpebral creases are usually located in the thinner skin area in Asians according to Choi's observation. The characteristic of the thin and smooth skin with inelastic, flexible outer fascia of OOM and without subcutaneous fatty layer in preseptal skin makes it the best region to form aesthetically thin folds [22, 23]. If the upper crease is formed in the thick upper eyelid skin with the tissue of sweat glands, hair follicles

and underlying subcutaneous fat or nearby the transitional point between thick skin and thin skin, an unnatural, heavy and puffy fold covered by thicker skin may be present.

If more skin was removed in the thin eyelid skin as in the traditional incision double-eyelid surgery, the subsequent suture will take place between the thick and thin skin of the eyelid, resulting in an unnatural eyelid fold, a “stepping-off defect” at the incision and an uneven closure with a more prominent scar [24, 25].

This is a common problem that the more the skin is excised in the thin skin of the preseptal region, the more the difference of skin thicknesses between the upper and lower flaps and the more the unnatural distribution of the suprapalpebral fold. The discrepancy in the thickness of skin that meets along the suprapalpebral crease accentuates the unnatural, unsmooth and full appearance of the upper flap in contrast to the thin pretarsal skin and crease, presenting an obvious surgical appearance in conventional blepharoplasty. The other problem is that unlike thin and soft tissue, thick and rigid tissue does not have the ability to conform to the underlying tissue and glide fine evenly distributed wrinkles. If there is a lack of support from the insufficient



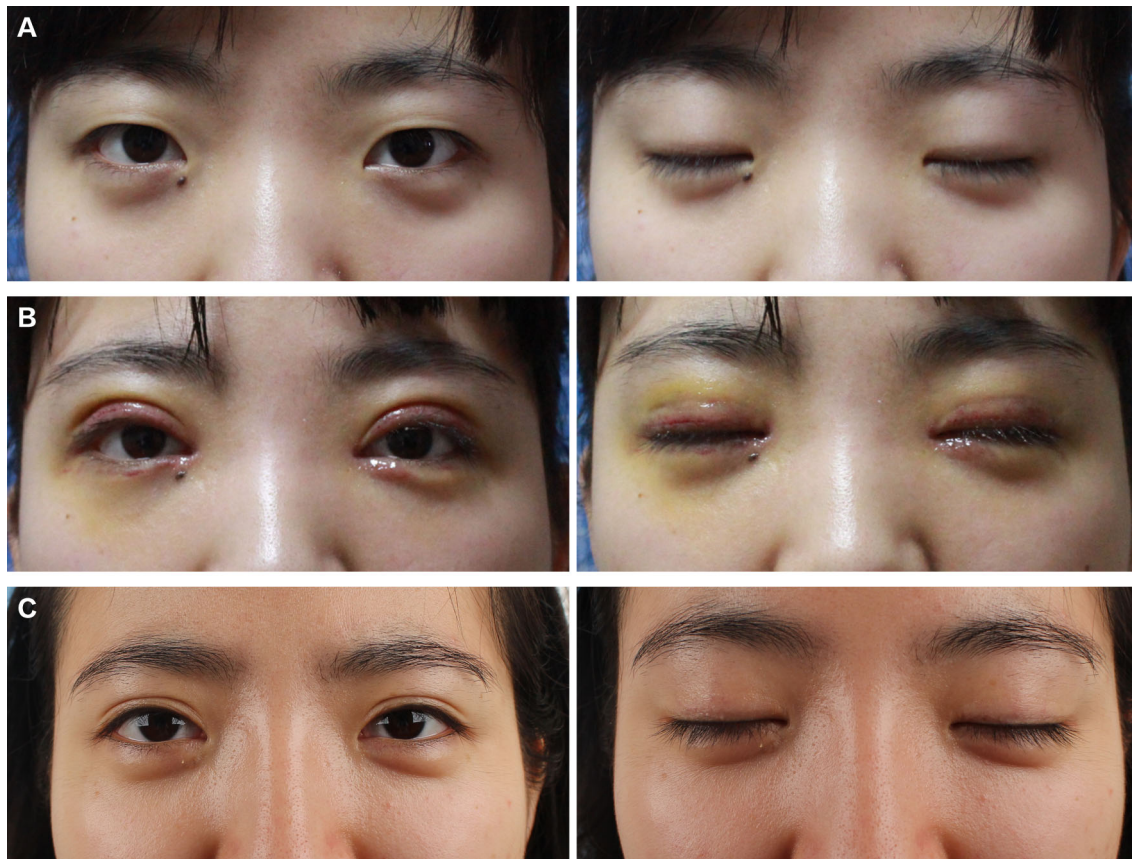
**Fig. 9** Photographs of a 21-years-old woman exhibiting a dynamic fold after he underwent double-eyelid surgery using the SCI technique and epicanthoplasty. A dynamic fold is characterized by gentle fold formation during eyelid opening (eye open in left column and eye

closed in right column). Preoperative views (**a**). Suture removal postoperative 1 week (**b**). Postoperative 3 months (**c**). One and a half year postoperative views (**d**) (Video 5)

underlying fat, the overlying skin and muscle layer folds at the weak points form a crease or multiple creases and the skin tends to dimple rather than spreading the redundancy evenly. It results in an unnatural-appearing supratarsal crease and lid crease discrepancy.

To avoid the shortcomings inherent in the conventional blepharoplasty technique, the thick skin excision at the infraorbital region is recommended for making a thin natural suprapalpebral fold [22, 26–29] in rejuvenation operations of the upper eyelid. The other approach was the partial excision of the thin pretarsal skin via palpebral margin incision, which was also suggested for this purpose in patients with redundant upper lid skin [16]. According to

the observation of Choi, the vertical height from the lid margin to the transitional point between the thin and the thick skin was 12.24 mm, and the vertical width of the thin pretarsal skin and the thin preseptal skin was 5.78 mm and 6.46 mm in young patients [22]. Kakizaki reported that the average height of the transitional line between the thin and thick areas was 17.8 mm (range 12.8–24.0 mm) [9]. This means that if the 6 mm width of the supratarsal crease is designed in the SCI approach, the eyelid fold is still below the transitional point after the 6 mm width of the upper eyelid skin is removed. It is beneficial to form the natural fold with light and thin fold edge.



**Fig. 10** Photographs of a 23-years-old woman exhibiting a dynamic fold after she underwent double-eyelid surgery using the SCI technique and epicanthoplasty. A dynamic fold is characterized by gentle fold formation during eyelid opening (eye open in left column

and eye closed in right column). Preoperative views (a). Suture removal postoperative 1 week (b). Postoperative 3 years and 10 months (c) (Video 6)

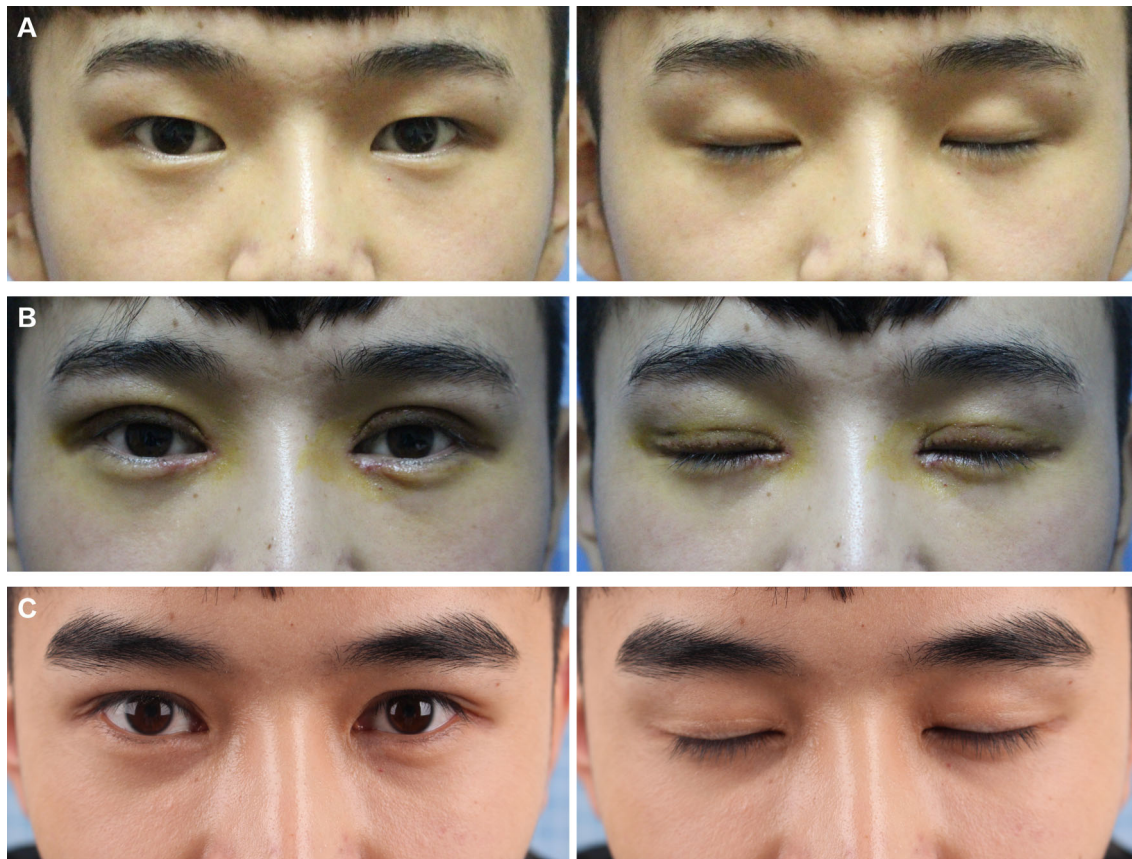
According to our clinical experience, the redundant skin of the upper eyelid can be removed in the thin pretarsal region after subcutaneous dissection is extended over the line of the designed crease through SCI. The suprapalpebral crease is still created and located in the thinner area of eyelid skin (Fig. 6) (Video 2). This procedure does not result in any skin tension affecting the position of the palpebral margin. The deformity of the palpebral margin and blinking problem were never occurred in our series. This surgical alteration can tighten the pretarsal skin and simultaneously position the eyelash upward in a more charming position, which results in larger looking eyes and a favorable cosmetic effect on the appearance of the Asian patient. Because the integrity and continuity of the upper eyelid skin are not interrupted by incision in our technique, the appearance of upper eyelid folds created in the region with thinner skin and normal transition of skin thickness would be more natural and aesthetic (Figs. 7, 8) (Videos 3, 4). The supraciliary incision is indicated for the creation of double eyelids in young patients, and infraorbital lifting is good for blepharochalasia in older patients.

### More Dynamic and Anatomic Morphology

As we all know, the septum fuses with the levator aponeurosis 5 to 10 mm above the tarsal border in the white upper eyelid, which allows for interdigitations of the levator aponeurosis extensions to the subdermal surface creating the higher supratarsal crease. The fibrous extensions of the levator aponeurosis are divided into superficial (anterior layer) extension distributed to the orbital septum, middle extension (the anterior insertion or fibrous branch from the fibroadipose anterior layer) inserted pretarsal OOM/dermis and deep extension (posterior layer) adhered to the superior tarsal border or the anterior surface of the tarsal plate [4, 30–33].

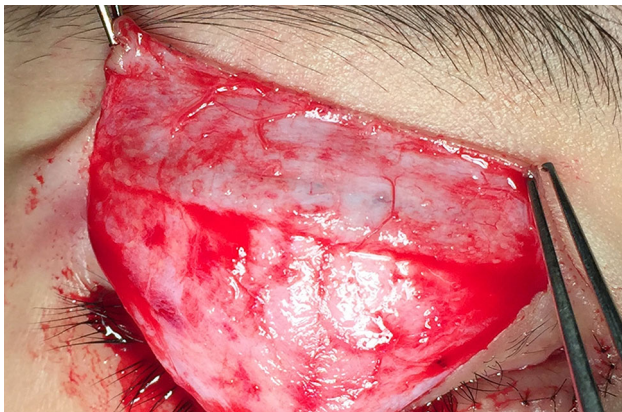
There is absent or less prominent fibrous attachment between the levator aponeurosis and the pretarsal or pre-septal OOM and skin dermis (middle extension) of the upper eyelid in the single-eyelid appearance of East Asians, which is different from the Western eyelid anatomically.

The anatomic characteristics in Asians include the lower-positioned transverse ligament and orbital septum and the inherent prominent preaponeurotic fat volume



**Fig. 11** Photographs of a 20-years-old man exhibiting a dynamic fold after she underwent double-eyelid surgery using the SCI technique and epicanthoplasty. A dynamic fold is characterized by gentle fold formation during eyelid opening (eye open in left column and eye

closed in right column). Preoperative views (a). Suture removal postoperative 1 week (b). Postoperative 3 years and 3 months (c) (Video 7)



**Fig. 12** The intact subdermal vascular networks were observed during the SCI blepharoplasty. The subdermal vessels run transversely near the eyelid margin and vertically in the orbital region

resulting in a single eyelid, narrow palpebral fissure and eyelid fullness [3, 30, 34]. The other anatomic studies in Asian eyelids suggest that the fusion region between orbital septum and levator aponeurosis and the inferior extension of the preaponeurotic fat pad are located lower or the

orbital septum and the preaponeurotic fat pad are prolapsed downward [33, 35–37]. All of the above-mentioned findings have impeded the natural formation of supratarsal creases.

Based on the understanding of the anatomic and dynamic system of the upper eyelid, the technical improvement in creation of double eyelid has been taken in our modified procedure. In the SCI procedure, the integration of the supraciliary incision and buried suture method is essential to create a more physiologically dynamic natural double eyelid. The purpose of the supraciliary incision is to present less surgical scar without a visibly depressed line and to preserve the continuity of the upper eyelid skin. The buried sutures placed between the dermis and the fusion part of the levator aponeurosis with the orbital septum and superficial extension of the levator aponeurosis are to recreate the anatomic structure and reestablish the dynamic mechanism of supratarsal creases (Fig. 9) (Video 5). In our operation, the burying location of sutures is neither passed through the tarsal plate nor fixed to the levator aponeurosis. The flipped orbital septum with superficial extension of the levator aponeurosis and the

fusion line of the levator aponeurosis with the orbital septum, sometimes called septoaponeurosis junctional thickening (SAJT) [38], are for the anchoring target tissue, and the fibrous links between the middle extension, anterior insertion of the levator aponeurosis and pretarsal OOM and dermis are achieved [3, 30, 32]. It is the key to create the dynamic fold of double eyelid and to imitate the natural supratarsal crease. When SAJT is used as a fixation structure in double-eyelid surgery, it effectively transmits the pulling power of the levator muscle to create the supratarsal fold (Fig. 10) (Video 6). It is also helpful to avoid the artificial appearance of an over-depressed, stiff, inflexible fold postoperatively. In addition, when the eyes are opening, the double-eyelid folds would be formed rather gently and gradually (Fig. 11) (Video 7).

## Conclusion

The present procedure combined the supraciliary approach and the internal buried suture method and offers a modified surgical approach in double-eyelid blepharoplasty for Asians. The primary indication for this procedure is for patients who do not wish to have a visible scar on the eyelids. The preliminary clinical practice and follow-up results have demonstrated its rationality, reliability, versatility and effectiveness. Its advantages include effectively avoiding visible scar formation, shorter postoperative edema, architecting the anatomical structure and reestablishing the dynamic mechanism of superior palpebral crease and creating a more smooth, aesthetic and natural appearance of double-eyelid fold.

**Funding** There is no financial disclosure to claim, and the research has no funds sponsored.

## Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflicts of interest to disclose.

**Research Involving Human and Animal Rights** This article does not contain any studies with human participants or animals performed by any of the authors.

**Informed Consent** For this type of study informed consent is not required.

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