

Fixation of orbicularis oculi muscle and orbital septum to pretarsal fascia and correction of blepharoptosis in construction of double eyelids

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Abstract

Objective: This study was performed to evaluate a novel method of constructing double eyelids by fixation of the orbicularis oculi muscle and orbital septum to the pretarsal fascia and correction of blepharoptosis.

Methods: In total, 285 patients requesting aesthetic construction of double eyelids were divided into three groups: those treated by the modified method (Group A, n = 108), those treated by traditional construction of the upper eyelid (Group B, n = 85), and those treated by the Park method (Group C, n = 92). The patients were followed up for 3 to 12 months (average, 6 months). The surgical effects and degree of satisfaction were compared among the three groups.

Results: In Group A, the mean operative time was 1.0 ± 0.2 hours. The degree of satisfaction with the surgical effect was significantly different between Group A (95.37%) and Group B (87.06%). However, no significant difference in satisfaction was noted between Group A (95.37%) and Group C (91.30%) or between Group B (87.06%) and Group C (91.30%).

Conclusions: The modified technique is simple and effective for construction of double eyelids and correction of blepharoptosis. All patients were satisfied with the surgical and aesthetic effects.

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Keywords

Orbital septum, orbicularis oculi muscle, pretarsal fascia, construction of double eyelids, blepharoptosis, aesthetic effect

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Introduction

Construction of double eyelids is the most common cosmetic surgical procedure in clinical practice.¹ Using the full incisional method, the orbicularis is cut off from the inner to outer canthus as one or several strips. The dermis and levator aponeurosis/tarsal plate are closely fixed with the cicatrix. The formed supratarsal fold is comparatively permanent.² The open procedure leaves a permanent crease, and the swelling lasts for longer than 3 months and even up to 1 year in some cases. Moreover, a distinct postoperative scar is unavoidable. The nonincisional technique is a convenient operation that allows for rapid recovery and no visible scar. However, the fold shaped by this technique may disappear in several years because the excessive pretarsal tissues affect the fixation, jeopardizing the effect of suturing. Many mini-incisional (semi-open) techniques with incisions of varying sizes have been developed, and these techniques have multiple advantages such as rapid recovery and indistinct scars.³ However, the amount of removed pretarsal tissues is insufficient because only small pockets of soft tissues inferior to the skin are resected for suture placement. Consequently, the double eyelids formed by this procedure may not be permanent. The aim of the present study was to resolve this issue. Based on the anatomical characteristics of the upper eyelid, the lower two-thirds of the orbicularis oculi muscle above the incisional margin and the orbital septum were fixed to the pretarsal fascia

to construct double eyelids. The surgical and aesthetic effects of this modified technique were evaluated and compared with alternative approaches.

Materials and methods

Baseline data

This study involved women scheduled to undergo construction of double eyelids in Rizhao People's Hospital and Cosmetic Center of the Affiliated Hospital of Qingdao University from November 2013 to December 2016. The patients were randomly divided into three groups using the random number table method. In Group A, patients underwent the modified method (fixation of the orbicularis oculi muscle and orbital septum to the pretarsal fascia). In Group B, patients underwent traditional construction of the upper eyelid. In Group C, patients underwent the Park method. The surgical indication was mild to moderate hypertrophy of the upper eyelid. Patients with severe hypertrophy of the upper eyelid were excluded. The study procedures were approved by the Ethics Committee of Rizhao People's Hospital (No. KYLL-RZSRMY20130926). Written informed consent was obtained from all participants.

Ptosis criteria

The normal position of the upper eyelid should be between the upper corneal margin and the pupil. If the upper eyelid

partially or totally covers the pupil and affects the normal visual field, the patient is considered to have blepharoptosis. Blepharoptosis can be divided into three degrees according to the phenomenon of droop: mild, moderate, and severe. In patients with mild blepharoptosis, the upper eyelid margin is located at the upper edge of the pupil. In patients with moderate blepharoptosis, the upper eyelid margin lies between the upper edge of the pupil and two-thirds of the pupil. In patients with severe blepharoptosis, the upper eyelid margin covers more than one-half of the pupil.

Surgical procedures

Preoperative preparation. The preoperative blood pressure was within the normal range in all patients. Chest radiographs and electrocardiograms demonstrated no abnormalities. Routine blood test results, bleeding and clotting times, and blood glucose levels were within normal limits. The patients were placed in the supine position, and the surgical area was disinfected three times with an iodophor solution and then draped with aseptic towels. The skin of the upper eyelid was disinfected with 75% alcohol. The incision line was drawn on the upper eyelid. A double eyelid line was drawn at a distance of 6 to 8 mm from the upper margin. The three highest points in the double eyelid line were marked on the bilateral sides with a distance of 1.0 to 1.5 cm. For correction of blepharoptosis, the removed skin was labeled according to the degree of sagging of the upper eyelid skin. The amount of skin to remove was determined using the "pinch technique" without the formation of an upper eyelid ectropion (Figure 1(a)). Local anesthesia was established by administration of 1% lidocaine and 1:200,000 adrenaline.

Intraoperative procedures. The skin and orbicularis oculi muscle were incised with a No. 11 blade along the methylene blue line. The skin at the lower edge of the incision line was separated to the palpebral margin. The pretarsal orbicularis oculi muscle below the cutting margin was cut. The pretarsal fascia was retained and the arterial arch of the palpebral margin was protected to prevent potential damage. If the orbital septum fat of the upper eyelid was excessive, the fat was partially resected through the opening of the orbital septum, and a bipolar electrocoagulation device was used to achieve hemostasis. The levator palpebrae muscle folding method was used to correct blepharoptosis, and double eyelid fixation was then performed. The three highest points in the double eyelid line were marked with a distance of 1.0 to 1.5 cm, and the lower two-thirds of the orbicularis oculi muscle above the cutting margin and the inferior aspect of the orbital septum were fixed to the pretarsal fascia with 6-0 silk suture. Lateral to the outermost mark, the lower two-thirds of the orbicularis oculi muscle above the cutting margin and the inferior aspect of the orbital septum were fixed to the pretarsal fascia on the same side; the opened orbital septum was closed at the same time if necessary. In patients with lacrimal gland prolapse, the lacrimal gland was separated, and the full thickness of the leading edge was sutured to the tear ducts with 6-0 silk suture and fixed on the periosteum of the lacrimal sac fossa. The skin along the cutting margin was sutured with 6-0 nylon in an interrupted fashion. Patients with mild ptosis underwent pleating of the levator palpebrae superioris (Figure 1(b), (c)). Traditional blepharoplasty was performed in Group B. The skin was sutured by simply hanging the tarsus. The Park operation was performed in Group C by fixing the orbicularis oculi muscle below the cutting margin to the upper eyelid aponeurosis internally.

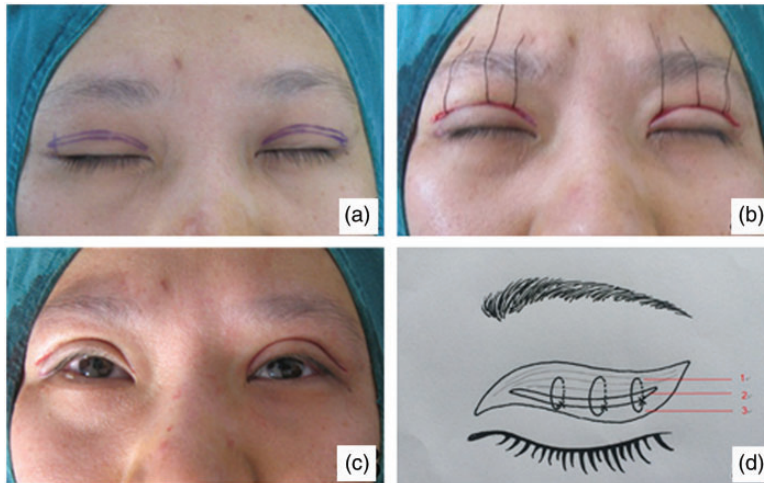


Figure 1. Operative procedures. (a) Design of double eyelid line. (b) Fixation of the orbicularis oculi muscle near the orbital septum above the cutting margin and the orbital septum to the pretarsal fascia. (c) Formation of the double eyelid with eyes closed. (d) Postoperative fixation effect. (1) Orbicularis oculi muscle above the cutting margin. (2) Orbital septum. (3) Pretarsal fascia.

Postoperative treatment. The upper eyelid was covered with gauze postoperatively. Adhesive plaster was applied over the gauze with low pressure to reduce postoperative bleeding. The dressing was removed after 24 hours, and the upper eyelid could move normally. Stressful activities were avoided as much as possible. The upper eyelid was observed once daily for 5 days postoperatively, and any abnormalities were treated in a timely fashion. At 5 days postoperatively, the sutures of the upper eyelid skin were removed.

Evaluation of surgical effect. The parameters related to the surgical effect were the symmetry and natural contour of the double eyelid line. During a postoperative follow-up of 3 to 12 months, the surgical effect was evaluated by the surgeons and patients, who reported that they were extremely satisfied, satisfied, or dissatisfied. Surgical complications included ptosis, insufficiency of upper eyelid closure, and ectropion.

Satisfaction was rated as satisfied, fine, poor, or failure as follows:

- **Satisfied:** The double eyelids were natural, aesthetic, and symmetrical. The surgeon, the patient, and a third person (friend or family member of the patient) were all satisfied.
- **Fine:** The double eyelids were natural and aesthetic, but the bilateral symmetry was not perfect and a defect was present that did not affect the overall outcome. The patient and a third person were satisfied, but the surgeon was not satisfied.
- **Poor:** The double eyelids were narrow, and satisfactory results were considered possible to obtain by a reoperation. The surgeon, patient, and a third person were not satisfied.
- **Failure:** The double eyelids were not formed or their shape was poorer than the preoperative appearance. The contour was not satisfactory. Infection or other complications had occurred.



Figure 2. A patient with blepharoptosis undergoing the modified method in Group A. (a) Preoperative preparation. (b) One week postoperatively. (c) Seven months postoperatively.

The surgeon, patient, and a third person were not satisfied.

Statistical analysis

Using SPSS 21.0 statistical software (IBM Corp., Armonk, NY, USA), we compared the postoperative satisfaction rate by the χ^2 test. A P value of <0.05 was considered statistically significant.

Results

In total, 285 women aged 18 to 40 years were included in this study (Group A, $n=108$; Group B, $n=85$; Group C, $n=92$). Fifteen patients also underwent correction of blepharoptosis, and five patients with mild ptosis underwent plication of the levator palpebrae superioris. All 108 patients in Group A underwent successful double eyelid construction by fixation of the orbicularis oculi muscle and orbital septum to the pretarsal fascia. The mean operative time was 1.0 ± 0.2 hours. The suture of the upper eyelid skin was removed at 5 days postoperatively, and the skin wound was well healed. All patients with blepharoptosis were fully treated. The upper eyelid radian was excellent, the eyelid symmetry was satisfactory, and no keratitis exposure was observed. The double eyelid line was natural and smooth. The degree of correction of blepharoptosis refers to the ptosis criteria of blepharoptosis described in the Methods. When binocular eyesight is flat, the upper

eyelid is located between the upper corneal margin and the pupil, which fails to cover the pupil. All patients were seated at the time of the examination. All patients in the three groups were followed up for 3 to 12 months postoperatively (average, 6 months). The cosmetic effects were good (Figures 2 and 3). The degree of satisfaction with the surgical effect was significantly different between Group A (95.37%) and Group B (87.06%) ($P < 0.05$). However, no significant difference in satisfaction was noted between Group A (95.37%) and Group C (91.30%) or between Group B (87.06%) and Group C (91.30%) (Tables 1 and 2).

Discussion

Traditional surgical methods for construction of double eyelids include incisions, buried sutures, and sutures. The incision method can remove skin and fat to make the lower edge of the incision completely adhere to the tarsal plate. However, the incision is large, the operation is complex, the duration of swelling is long, and the postoperative scar is obvious; these disadvantages are difficult for many patients to accept. The buried suture method and suture method are relatively simple to perform and allow for rapid recovery. However, the skin and fat cannot be removed, and so these methods lack persistence. These methods are more suitable for patients with tight upper eyelid skin and

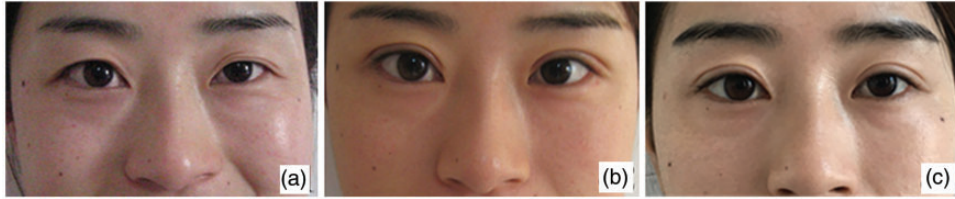


Figure 3. A patient with asymmetrical eyelids accompanied by left mild ptosis after the modified method in Group A. (a) Preoperative preparation. (b) Two weeks postoperatively. (c) Twelve months postoperatively.

Table 1. Comparison of postoperative satisfaction rate among the three groups.

	Operative type	Satisfied	Fine	Poor	Failure	Satisfaction rate
Group A (n = 108)	Modified method	103	5	0	0	95.37%
Group B (n = 85)	Traditional method	74	11	0	0	87.06%
Group C (n = 92)	Park method	84	8	0	0	91.30%

Data are presented as number of patients.

Table 2. Statistical comparison of postoperative satisfaction rate among the three groups.

Group comparison	χ^2	P-value
Groups A and B	4.322	0.038
Groups A and C	1.351	0.245
Groups B and C	0.831	0.362

Note: The satisfaction rate between Groups A and B was significantly different ($P < 0.05$). No significant difference was noted between Groups A and C or between Groups B and C.

less effective for those with relaxed upper eyelid skin.

Construction of double eyelids is one of the most common aesthetic plastic surgery procedures. The traditional construction of double eyelids fails to retain the lower two-thirds of the orbicularis oculi muscle above the cutting edge and to fix the orbital septum to the pretarsal fascia.⁴ Multiple postoperative complications can occur; e.g., the double eyelid line often becomes shallow or narrow. Previous studies have demonstrated that the double eyelid line becomes shallow or narrow because the

incised eyelid skin and the pretarsal fascia are not fixed tightly.^{5,6} The double eyelid line may also become shallow or narrow because of excessive fat under the muscle and insufficient removal of the fat. Consequently, the adhesion between the skin and pretarsal fascia is weak and unstable.⁷ In the present study, the patients had mild to moderate hypertrophy of the upper eyelids. After the lower two-thirds of the orbicularis oculi muscle above the cutting edge and the orbital septum were fixed to the pretarsal fascia with sutures, the position of the double eyelid line remained fixed and stable. The postoperative effect remained unchanged. The width and shape of the double eyelid were maintained for 1 year without significant changes.

During the operation, the lower two-thirds of the orbicularis oculi muscle above the cutting edge and the orbital septum were fixed to the pretarsal fascia, where three markers were created at the highest point in the double eyelid line on the bilateral sides with a distance of 1.0 to 1.5 cm.⁸ The double eyelid shape was thus confirmed. The patients were asked to open

their eyes to observe whether the double eyelid shape was ideal and whether the bilateral part was symmetrical after fixation of the lower two-thirds of the orbicularis oculi muscle above the cutting edge and the orbital septum to the pretarsal fascia. If the shape of the double eyelid was not satisfactory, certain interventions were implemented to improve the aesthetic effect. Therefore, fixation of the lower two-thirds of the orbicularis oculi muscle above the cutting edge and the orbital septum to the pretarsal fascia can achieve favorable outcomes in the construction of double eyelids.

This novel modified technique prevents the orbital septum fat from extruding to the double eyelid line below, which may exert an adverse effect on the shape of the double eyelid. In addition, this technique can prevent retraction of the orbital septum fat and the appearance of extra wrinkles over the double eyelid line, which may lead to poor cosmetic results. Some authors have reported that multi-layer eyelids occur after the construction of double eyelids.^{9,10} After removal of the skin and orbicularis oculi muscle, especially in patients who have undergone removal of a significant portion of the orbicularis oculi muscle, the retraction of the orbicularis oculi muscle is not pulled and sutured to the incision. Consequently, the wrinkles above the double eyelid line cause a multi-layer eyelid.¹¹ In the present study, fixation of the orbital septum and part of the orbicularis oculi muscle above the cutting margin to the pretarsal fascia avoided the formation of multi-layer eyelids. When fixing the bottom of the orbital septum and lower two-thirds of the orbicularis oculi muscle above the cutting edge to the pretarsal fascia, another suture was created lateral to the outermost marker point on the double eyelid line if necessary, and the open orbital septum was closed to decrease the risk of herniation of the orbital septum

fat and assist the formation of the double eyelid line.

Intraoperatively, the skin of the lower edge of the incision line was separated from the palpebral margin, the pretarsal orbicularis oculi muscle below the incision was resected, and the pretarsal fascia tissues were retained. This maneuver ameliorated the postoperative inflammation below the double eyelid line to achieve an optimal outcome. The traditional operative method is to remove the pretarsal fascia tissues to facilitate the formation of adhesions between the skin and tarsus below the double eyelid line. This novel technique also averts the need for postoperative adhesion formation between the skin and tarsus below the double eyelid line. When the pretarsal orbicularis oculi muscle below the cutting edge was resected, the pretarsal fascia tissues were retained, resulting in adequate blood circulation and lymphatic flow postoperatively and accelerated postoperative recovery.

In the present study, the suture line started from the deep surface of the inferior aspect of the orbital septum and extended to the deep surface of the orbicularis oculi muscle above the cutting edge. After the suture emerged between the upper one-third and lower two-thirds of the orbicularis oculi muscle above the cutting edge, the suture line descended along the superficial surface of the orbicularis muscle and then passed through the shallow inferior surface of the orbital septum and pretarsal fascia. The suture line was knotted and fixed to the inferior aspect of the deep surface of the orbital septum. Thus, the suture junction was buried in the inferior aspect of the deep surface of the orbital septum in the event that the suture knot was revealed. The lower two-thirds of the orbicularis oculi muscle was fixed, and the shape of the double eyelid could be confirmed. There was no risk of exposure of the suture line by being buried too shallow.

The Park operation is a double-stitch approach to fixation of the orbicularis oculi muscle below the cutting margin to the upper eyelid aponeurosis internally and the eyelid skin simultaneously. Park et al.^{10,11} fixed the orbicularis oculi muscle below the cut edge, leading to a fixed and durable shape of the double eyelids. Compared with the Park operation, our modified method conforms more closely to the anatomical features and is easier to perform. The double eyelid shape is more natural and durable. The Park method preserves the orbicularis oculi muscle below the cutting margin, which is more ideal for patients with thinner upper eyelid tissues than for patients with hypertrophic upper eyelid tissues. Because the Park operation does not cut the orbicularis oculi muscle below the cutting margin, the upper eyelid at the bottom of the cut edge appears hypertrophic. In our improved method, the orbicularis oculi muscle below the cutting margin is resected. Therefore, the upper eyelid at the bottom of the cut edge is thinner after the operation, and the shape is more satisfactory. In addition, fixing the lower two-thirds of the orbicularis oculi muscle above the cutting margin and orbital septum to the pretarsal fascia can make the upper eyelid tissues above the cut edge thinner, thereby reducing the occurrence of postoperative hypertrophic upper eyelid tissues. Because the lower two-thirds of the orbicularis oculi muscle above cutting margin and the bottom of the orbital septum are fixed to the pretarsal fascia, more skin and muscle can be removed than in the Park method. Therefore, the effect of the correction of the upper eyelid relaxation is more ideal. Moreover, the orbicularis oculi muscle above the cutting margin and the orbital septum are partially fixed to the pretarsal fascia intraoperatively. The height can be adjusted by fixation. The orbicularis oculi muscle can be fixed neither to the

transitional between the pretarsal fascia and upper eyelid aponeurosis nor to the pretarsal fascia below the upper tarsus. In the Park operation, the fixed position is the superior border of the tarsus or higher. The double eyelid width is wider, and this method is thus more suitable for the patient population in the West. Our modified method can adjust the width of the double eyelid, which is more suitable for Asians.

In our modified construction of the upper eyelid, the silk sutures and nylon monofilament are foreign bodies; thus, rejection may occur. Although this phenomenon did not appear during the postoperative follow-up, a longer duration of close observation is urgently required. Additionally, our method is associated with a theoretical risk of infection. The suture line may produce a cutting force to the tissue. Whether this will affect the postoperative double eyelid shape and persistence of the surgical outcome requires a longer observation time. We fixed more points in our subsequent operations. Whether this will avoid changes in the shape of the eyelid also requires further observation.

In conclusion, the modified method is simple and effective in producing a satisfactory eye shape after the construction of double eyelids. A more satisfactory aesthetic effect of both double eyelid construction and blepharoptosis correction can be obtained compared with the traditional double eyelid surgery and Park method.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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