



Local retro-orbicularis oculus fat (ROOF) resection in upper blepharoplasty: A retrospective evaluation study of 65 bilateral upper blepharoplasties[☆]

Y.S. Zhang, Q. Zhou, J. Zhang, G.Z. Niu, X.Y. Huang, C.Y. Liu, Y.P. Qiu, C.Y. Zheng, Y.L. Bi*

Department of Ophthalmology, Tongji Hospital, Tongji University School of Medicine, 389 Xin Cun Road, Putuo district, Shanghai 200065, China

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KEYWORDS

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Summary Background: Puffy upper eyelids are normal in Asians, and full-incision blepharoplasty is commonly performed to remove some orbital fat to ameliorate the problem, but not all patients would exhibit obvious improvement. Local retro-orbicularis oculus fat (ROOF) is a layer of fibrofatty soft tissue that lies much deep into the orbicularis oculi in the upper eyelid, which is an important factor in the formation of puffy upper eyelids. This study was carried out to evaluate the clinical application (including the evaluation of photographs for the thickness of upper eyelid) of upper blepharoplasty combined with ROOF resection for correcting puffy upper eyelids.

Method: A total of 65 patients (5 males, 60 females) with puffy upper eyelids recruited from October 2015 to October 2016 were included in the study. Full-incision blepharoplasty combined with partial ROOF resection was performed on all patients. The thickness of soft tissue in the upper eyelid was measured by ultrasound biomicroscopy preoperatively and at 12 months postoperatively.

Result: All patients underwent surgery successfully, and 62 patients (124 eyes) were followed up for 12–15 months (mean 13.8 ± 2.7 months). Before the surgery, the thickness of the ROOF was 0.35 ± 0.12 mm on the left and 0.42 ± 0.08 mm on the right. Twelve months postsurgery, the thickness of the ROOF was 0.18 ± 0.03 mm on the left and 0.20 ± 0.02 mm on the right. During the follow-up period, all patients were satisfied with the esthetic effect, and no severe postoperative complications were observed.

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*Corresponding author.

E-mail address: biyanlong@tongji.edu.cn (Y.L. Bi).

Conclusion: Puffy upper eyelids can be corrected effectively by local ROOF resection in esthetic blepharoplasty.

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Introduction

Upper eyelid blepharoplasty is one of the most popular cosmetic surgeries in Asia, as nearly one-half of the Asian population lacks a supratarsal fold.¹ The traditional oriental esthetic standard has been a thin and soft double-eyelid shape, but puffy upper eyelid is a common eyelid shape among Orientals. The thickness of the upper eyelid depends on the internal structure of the eyelid. To reduce the heaviness of the upper eyelid, part of the orbicularis oculi muscle and the orbital fat are usually resected during plastic surgery, but this method is not entirely suitable for all patients.^{2,3} The anatomical structure of the upper eyelid of different people is not exactly the same. In the upper eyelid, the retro-orbicularis oculus fat (ROOF) is defined as “a layer of fibrofatty soft tissue deep to the orbicularis oculus muscle, superficial to the orbital septum and orbital rim, and extending medially from the superior orbital nerve and laterally to a varying distance over the lateral upper orbit”.⁴ Many people have thick ROOF but thin orbital fat. We screened out such patients by subjective and objective evaluation, including bent paper clip press evaluation, photographs, and ultrasound biomicroscopy (UBM) measurements, which can indicate the extent of upper eyelid puffiness and provide a basis for the removal of soft tissue during surgery. For these people, a simple orbicularis muscle and orbital fat removal cannot sufficiently improve the appearance of a puffy upper eyelid.⁵ ROOF resection is often performed simultaneously to achieve a desired and symmetrical appearance and to relieve the puffiness of upper eyelid. In this report, we describe the results of the local ROOF resection in blepharoplasty for patients with puffy upper eyelids.

Materials and methods

This study complies with the Reporting of Observational Studies in Epidemiology (STROBE) statement.

Patients

From October 2015 to October 2016, a total of 65 patients (130 eyes) requesting double-eyelid blepharoplasty who were evaluated to have puffy upper eyelids at our institution were studied. The patients included 5 males and 60 females. Their age ranged from 18 to 38 years, with a mean age of 22.7 ± 8.3 years. The inclusion criteria were based on the results of subjective bent paper clip press evaluation, front and lateral photographs, and the UBM measurement of the upper eyelids. The subjective bent paper clip press evaluation was as follows: The patient takes the standing position and closes his eyes, presses the upper eyelid with



Figure 1 Evaluation of the degree of puffy upper eyelid. Line “a” is the line along the upper eyelid margin at a downgaze position; line “b” is the line vertical to line “a” when crossing the nadir of the eyelid margin, and line “c” is the eyelid apex tangent line parallel to line “b.” The distance between line “b” and line “c” represents the degree of puffy upper eyelid.

a bent paper clip, and then opens the eyes. If the double-eyelid line is easy to form, then the hypertrophic part is more likely to be orbital fat, and if the double-eyelid line is difficult to form or immediately disappears after loosening, then it indicates that the hypertrophic part may be the ROOF.⁶ When some patients open their eyes, the doctor can clearly feel the bent paper clip and the levator aponeurosis clinging but cannot feel the obvious subcutaneous fat or ROOF. These patients who were judged to have a thin upper eyelid can be excluded. Next, the photographs and ultrasound biomicroscopy (UBM) measurements were adopted as the objective methods. All included patients had an upper eyelid thickness of more than 3.8 mm in the photograph evaluation, and the thickness of all layers was more than 1.6 mm as indicated by the UBM. In this study, we excluded patients with obviously sunken sockets, obviously flappy upper eyelid skin, previous double-eyelid operation within six months, upper eyelid entropion, and levator palpebrae dysfunction.

Photograph evaluation

The degree of puffy upper eyelids was evaluated directly from the photographs. The distance between the (intended) double-eyelid line and the edge of the upper eyelid was measured at the downgaze position with the vertical upright position of the head before and 12 months post-surgery (Figure 1).

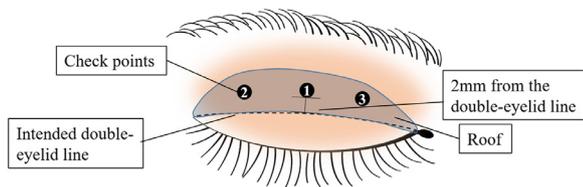


Figure 2 UBM scanning points: The check points measuring the thickness of the upper eyelid 2 mm above the intended double-eyelid line. Point 1: 2 mm above the midpoint of the intended double-eyelid line. Point 2: the midpoint of point 1 and the outer canthus angle. Point 3: the midpoint of point 1 and the inner canthus angle. The average value of these three points was taken.

UBM for upper eyelid thickness

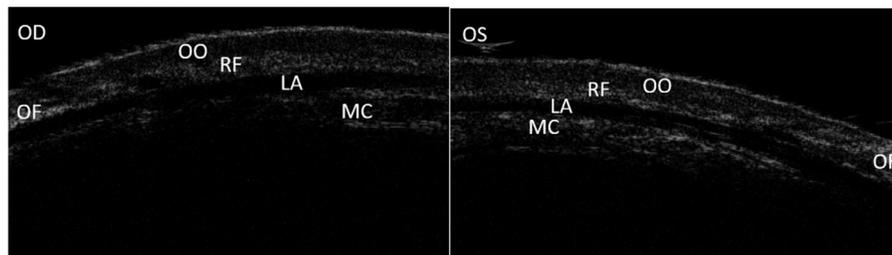
A pair of external eye contact goggles was modified to accomplish the UBM examination by hollowing out a $3\text{ cm} \times 2\text{ cm}$ rectangle area at the center of each eyeglass lens. The modified, hollowed-out goggles provided a larger scanning area than the traditional UBM eyecups, so that the whole upper eyelid could be scanned by the ultrasonic probe. The patients took a supine position for the downgaze with their eyes closed. Water was poured into the goggles to a depth of 1.5 cm, and the upper eyelid was imaged with an ultrasound biomicroscope (SW-3200) using a 50 MHz probe

by an experienced ultrasonographic technician. The scanner produced a 4 mm depth field with a 40-80 dB dynamic accommodation. The probe was placed perpendicular to the area of interest at one temporal point at the upper one-third between the orbital margin and the upper eyelid margin for one eye (Figure 2). The thickness of the orbicularis oculi muscle, ROOF, levator aponeurosis, and all the layers was measured before and 12 months postsurgery (Figure 3).

Surgical procedure

Full-incision blepharoplasty combined with local ROOF resection was performed on all patients by the same experienced surgeon. The intended double-eyelid lines were designed according to the patients' requirement. After anesthesia, the eyelid skin was cut along the intended double-eyelid line, and the orbicularis oculi muscle between the skin incision and the eyelid margin was excised. A 1 cm incision was made above the orbital septum, the orbital fat was bulged out naturally with moderate squeezing of orbital circumference, and the excess fat was removed. After the blunt separation along the orbicularis oculi muscle from the skin incision, part of the ROOF tissue was pulled and cut off at a height of 2 mm, which is the width of the length of the eyelid incision (Figure 4). Care was taken not to damage the superior orbital nerve during the ROOF resection. Wound closure was conducted in the standard manner with 8-0 silk threads.

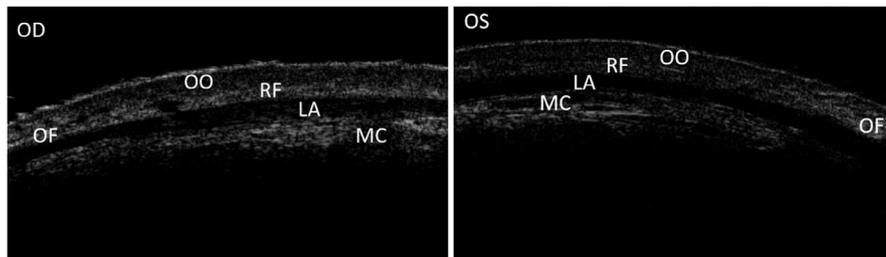
A. Pre-surgery



(a)

(b)

B. 12 months post-surgery



(c)

(d)

Figure 3 UBM images of a 28-year-old girl's upper eyelid. (A) Before surgery, the upper eyelid structures were measured at points 1, 2, and 3. (a) On the right side, the thickness of the orbicularis oculi (OO) muscle is 0.61 mm, the ROOF (RF) is 0.57 mm, the levator aponeurosis (LA) is 0.60 mm, and the orbital fat (OF) is 0.64 mm. (b) On the left side, the thickness of the OO muscle is 0.52 mm, the RF is 0.42 mm, the LA is 0.58 mm, and the OF is 0.58 mm. (B) 12 months after surgery. (c) On the right side, the thickness of the OO muscle is 0.59 mm, the RF is 0.25 mm, the LA is 0.58 mm, and the OF is 0.30 mm. (d) On the left side, the thickness of the OO muscle is 0.48 mm, the RF is 0.21 mm, the LA is 0.60 mm, and the OF is 0.26 mm. Müller muscle-conjunctival complex (MC).

Table 1 UBM measurement of eyelid thickness pre- and postsurgery.

	Left			Right		
	Presurgery	12 months postsurgery	<i>P</i> value	Presurgery	12 months postsurgery	<i>P</i> value
OO (mm)	0.46 ± 0.05	0.42 ± 0.02	<0.01 ^b	0.60 ± 0.06 ^a	0.45 ± 0.05	0.01 ^b
LA (mm)	0.43 ± 0.12	0.43 ± 0.10	0.79	0.40 ± 0.06	0.40 ± 0.05	0.36
ROOF (mm)	0.35 ± 0.12	0.18 ± 0.03	<0.01 ^b	0.42 ± 0.08 ^a	0.20 ± 0.02	<0.01 ^b
OF (mm)	0.49 ± 0.04	0.30 ± 0.05	<0.01 ^b	0.58 ± 0.06 ^a	0.30 ± 0.06	<0.01 ^b
Thickness of all layers (mm)	1.79 ± 0.11	1.56 ± 0.11	<0.01 ^b	1.96 ± 0.08 ^a	1.61 ± 0.04	<0.01 ^b

UBM was measured 2 mm above the intended double-eyelid line.

^a Left and right side comparisons at the same time were statistically significant ($p < 0.05$). There were significant differences in the thickness of OO, ROOF, OF, and all layers between the right and left eyes before the surgery, and there was no difference after the surgery, which tended to be symmetrical.

^b Preoperative and postoperative comparisons on the same side were statistically significant ($p < 0.05$), which means part of the soft tissue was removed during the surgery. OO: orbicularis oculi; LA: levator aponeurosis; OF: orbital fat; All layers include OO, ROOF, LA, and MC (Müller muscle-conjunctival complex).

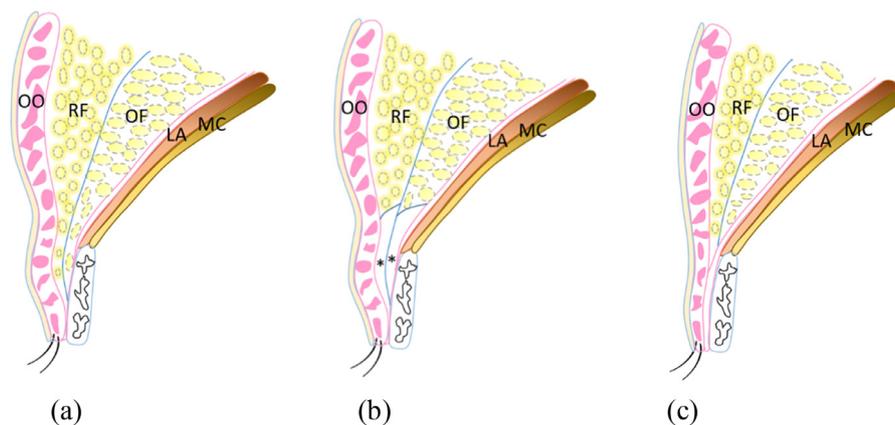


Figure 4 Surgical procedure: (a) ROOF located deep into the orbicularis oculi; (b)*: part of the ROOF and the orbital fat were removed during surgery; (c) puffy upper eyelid was improved postoperation.

Statistical analysis

Student's paired *t*-test was used to compare the UBM differences between presurgery and postsurgery. $P < 0.05$ was considered statistically significant.

Results

Sixty-five patients successfully underwent surgery conducted by the same doctor using the full-incision blepharoplasty combined with ROOF resection, and 62 patients (124 eyes) were followed up for 12-15 months (mean 13.8 ± 2.7 months). No major complications occurred, including eyebrow raised, eye closed, frowning, and other dysfunctions. Postoperative swelling and hematoma were not significant. All the patients responded to the effect that the thickness and heaviness of their upper eyelids improved and were satisfied with the natural appearance. The average height of the designed upper eyelid line was 7.33 ± 0.41 mm, and the width measured from photographs (Figure 1) was 4.35 ± 0.48 mm presurgery and 3.27 ± 0.31 mm at 12 months postsurgery ($p < 0.01$). The UBM eyelid thickness

measurements are shown in Table 1. The typical cases are shown in Figures 5 and 6.

Discussion

Compared with those of Caucasians, the upper eyelids of Asians are plumper and bloated, with a single-eyelid or in-fold double-eyelid shape.⁷ Evaluating an individual's puffy eyelid does not have an objective data standard. In our study, the subjective bent paper clip press evaluation⁶ can exclude a small number of patients and can indicate the prognosis to a certain degree. Apart from the subjective method, all patients were evaluated from the outside appearance and inside structure by the UBM. All patients had an upper eyelid thickness of more than 3.8 mm in the photograph evaluation, and the thickness of all layers was more than 1.6 mm as indicated by the UBM. Our previous study showed that significant differences could be found in the soft tissue thickness between the right and left upper eyelids.⁸ The orbicularis muscle, ROOF, and orbital fat were thicker on the right side than on the left side before surgery (Table 1). Moderate soft tissue was removed during the surgery according to the result of UBM, and it became more

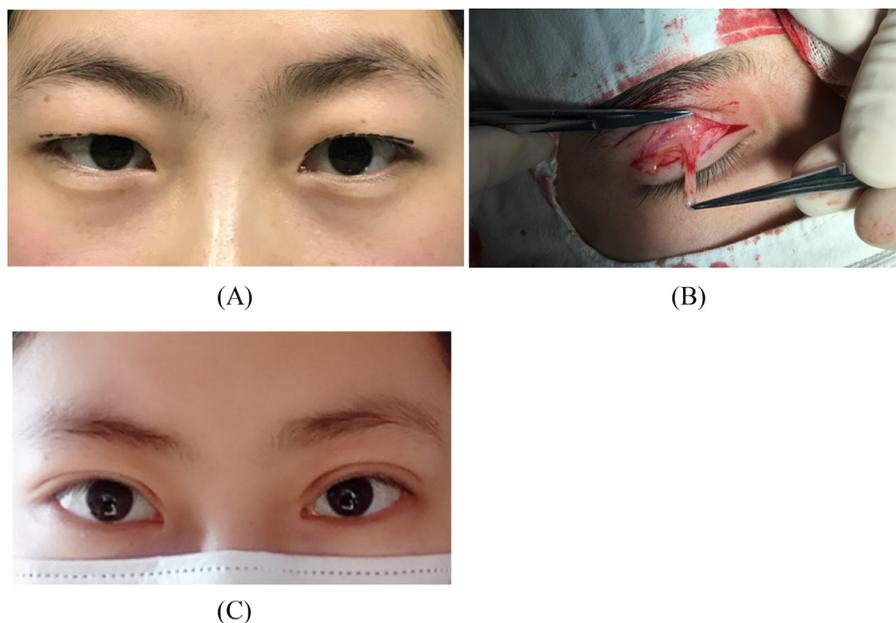


Figure 5 Case 1: (A) A 28-year-old woman with severe puffy upper eyelid; the right side is heavier than the left. (B) Part of the ROOF resection during the surgery. (C) 10 months postsurgery, with eyes opening easily. The patient was satisfied with the natural double-eyelid.

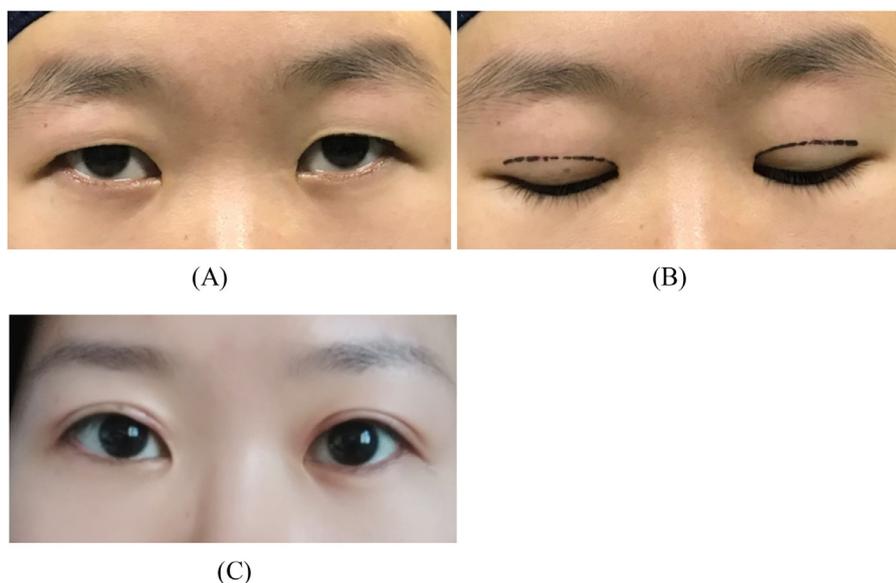


Figure 6 Case 2: (A) A female patient with thick eyelid soft tissue in both eyes. (B) Intended double-eyelid line. (C) 12 months postsurgery with thin and soft double-eyelids.

symmetrical when compared with the bilateral eyelid thickness.

UBM is commonly used in ocular ganglia structure examination and disease diagnosis because it is economic and noninvasive. In recent years, the UBM technology has been gradually used in measuring the normal tissue of the upper eyelid.⁹ In our study, the UBM measurement of the upper eyelid thickness was taken as a reference to evaluate the preoperative and postoperative bloated degree of the upper eyelids. The thickness of the upper eyelid presurgery was 1.79 ± 0.11 mm in the left eye and 1.96 ± 0.08 mm

in the right eye. Twelve months postsurgery, the thickness of the upper eyelid was 1.56 ± 0.11 mm in the left eye and 1.61 ± 0.04 mm in the right eye. Preoperative and postoperative comparisons were statistically significant in both eyes ($p < 0.05$). It is a more objective method than a doctor's experience.

For patients with puffy eyelids, full-incision blepharoplasty is commonly performed to remove some orbital fat to ameliorate the problem, but not all patients would exhibit obvious improvement.¹⁰ ROOF lies much deep into the orbicularis oculi in the upper eyelid without important

vessels and nerves.¹¹ This anatomic feature suggests that the proper resection of the orbicularis oculi muscle and the excess orbital fat may not reduce the puffy upper eyelids of all patients.⁵ Some patients had thick ROOF but thin orbital fat.¹² ROOF can also cause nonlasting double-eyelids. When the eyes open, the ROOF tissue squeezes the eyelid so that forming a double-eyelid becomes difficult. After a local ROOF resection, the double-eyelid line can last for a long time. ROOF comprises gliding tissues, the resection of which causes the adhesion of the orbicularis oculi to the levator. Note that not all ROOF tissues can be resected, as only part of it can be cut off to avoid the adhesion of the orbicularis oculi to the levator.¹³ Currently, ROOF pruning is still an advanced and novel technique in China. Ichinose and Tahara proposed the role of preseptum fat combined with ROOF excision for upper eyelid swelling, but the postoperative results were evaluated only through a subjective morphological observation, patients' satisfaction survey, and postoperative complications.¹⁴ In the current study, objective data were provided to support the curative effect of ROOF pruning, regardless of the contrast of the pre- and postoperative shape or the apparent change in the thickness of the upper eyelids, and they all indicated that ROOF pruning is an effective way to correct upper eyelid heaviness.

Conclusion

Given the characteristics of the tissue morphology of the upper eyelids of Asians, local ROOF resection in esthetic blepharoplasty is a safe method to effectively correct puffy upper eyelids.

Ethical approval

The study received approval from the Medical Ethical Committee of the Tongji Hospital, Tongji University School of Medicine. Informed consent of the patients was not required.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.bjps.2019.04.010](https://doi.org/10.1016/j.bjps.2019.04.010).

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