

The Clinical Outcomes of Small-incision Browpexy

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Purpose: To present clinical outcomes of small-incision browpexy in patients with mild brow ptosis without significant suprabrow skin redundancy.

Methods: Eleven patients who underwent small-incision browpexy procedures were clinically evaluated over a period of 6 months, including a review of their charts. Small-incision browpexy was performed through two 5 mm incisions in the central and lateral brow. Measurements and comparisons were made of the preoperative and 6-month postoperative brow-to-pupil distance (BPD), the brow-to-medial canthus distance (BMCD), and the brow-to-lateral canthus distance (BLCD).

Results: Postoperative BPD, BMCD, and BLCD increased 1.10 ± 0.89 mm, 0.20 ± 0.54 mm, and 1.37 ± 1.04 mm, respectively, in 11 patients (21 eyes). Results were statistically significant, in terms of change with BPD and BLCD ($p=0.009$, $p<0.001$), but not with BMCD ($p=0.477$).

Conclusions: The small-incision browpexy is a useful brow-lifting procedure in mild brow ptosis. The procedure is quick, minimally invasive, and particularly effective in central and lateral brow ptosis.

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Key Words: Blepharoptosis; Brow lift; Browpexy; Eyebrow ptosis

INTRODUCTION

An eyebrow lift, which corrects brow ptosis is found to be used functionally and for aesthetic reasons, in that it can correct the contours or asymmetries of eyebrows, weaken the depressor supercillii, and lessen forehead wrinkles.^{1,2} Aging in the upper face progresses faster than that in the lower face and is marked initially by the deflection of the temporal eyebrow.³ When aging eyelids are corrected by

the upper eyelid surgery only, complications may occur, such as shortening of vertical length due to excessive skin excision or lagophthalmos from scar formation.⁴

Eyebrow ptosis is often present in patients with blepharoptosis or dermatochalasis. Eyebrow ptosis is sometimes concealed by excessive use of the forehead muscles to lift droopy eyelids. After the upper eyelid surgery, eyebrow deflection appears, as the forehead muscles are not used anymore.⁵ For this reason, eyebrow-raising is often necessary when performing upper eyelid plastic surgery. A variety of eyebrow lifts are performed, including direct eyebrow lift, internal fixation, and endoscopic eyebrow lift.⁶⁻¹⁰ We have modified the external browpexy technique by Massry,⁶ using two small-incision windows on the central and lateral brow, and are reporting the effect of this procedure.

MATERIALS AND METHODS

We performed a small-incision browpexy in patients with

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mild eyebrow ptosis without significant suprabrow skin redundancy in patients who visited the clinic from June 2012 to June 2016. Among them, the patients we were able to track down for over 6 months were included, and their medical records and photographs were reviewed retrospectively. Patients who had previously undergone eyebrow or eyelid surgeries were excluded from this study. The study was approved by the Institutional Review Board (IRB) (approval number 2015-04-018).

Surgery was performed in the following manner: the patient was seated upright, and the markings of two incisions were made, about 1 mm above the eyebrow in the center and lateral areas. After injecting a mixture of xylocaine and hyaluronidase into the marked area, a skin incision of about 5 mm was made, and the subcutaneous tissue and the orbicularis muscles were dissected down to the periorbita. The orbicularis muscle and subcutaneous tissue were fixed to the periosteum at an appropriate height, using a 5-0 prolene suture (Fig. 1). The patient was seated upright again to check whether the eyebrows were positioned properly. The dermis was sutured with 6-0 vicryl, and the skin was closed with 6-0 nylon. After a small-incision browpexy, all patients underwent an upper lid blepharoplasty.

Pictures were taken before and 6 months after surgery with a digital camera (Cannon EOS 650D, Cannon, Tokyo, Japan). To minimize the error caused by photography, the one photographer took the photos in the same environment - measurement distance, angle, illumination, etc. - and the pupil axis located at the center height of the camera lens.

The pictures were analyzed using the ImageJ program (the National Institutes of Health [NIH], Bethesda, MD, USA), a Java system developed by NIH. We drew a vertical

line from three points at the pupil center, medial and lateral canthus. The distance from the three points to the upper border of the eyebrows was measured five times, and the mean value was used. These parameters were named brow-to-pupil distance (BPD), brow-to-medial-canthus distance (BMCD) brow-to-lateral-canthus distance (BLCD) (Fig. 2). Four criteria were used to compare the preoperative and postoperative pictures; 1) an imaginary horizontal line connecting the center of pupils, 2) center point bisecting the horizontal line, 3) a vertical line perpendicular to the horizontal line at the center point, and 4) medial canthal angle.

Statistical analysis was performed using IBM SPSS ver. 20.0 for Windows software (IBM Corp., Armonk, NY, USA). The Wilcoxon signed rank test was used to compare the difference between the left and the right eyes. The difference between the preoperative and 6 months postoperative was analyzed by McNemar's test. The intraclass correlation

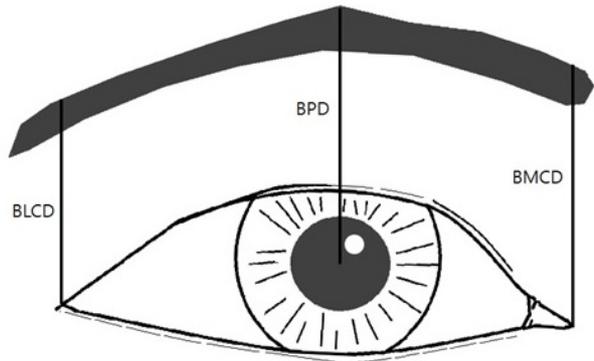


Figure 2. Schematic picture of the clinical parameters for the brow position measured. BPD = brow-to-pupil distance; BMCD = brow-to-medial canthus distance; BLCD = brow-to-lateral canthus distance.

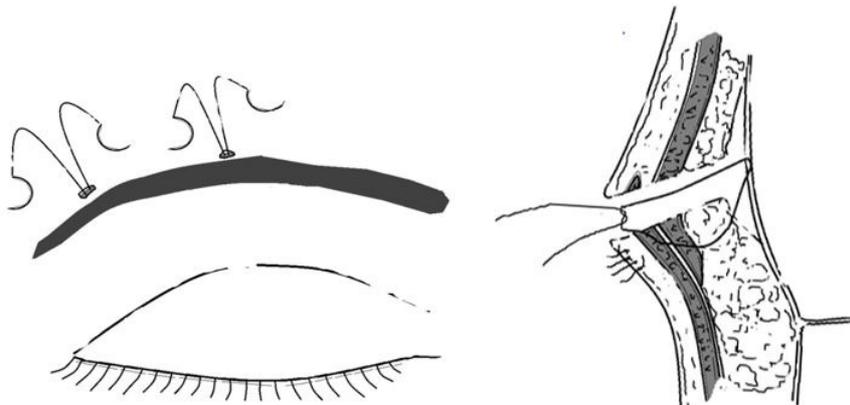


Figure 1. A drawing of small-incision browpexy procedure. Left, frontal view of suprabrow incision, about 5 mm, with suture fixation. Right, sagittal view of suture depth and placement through periosteum, brow fat, and frontalis/orbicularis oculi interdigitation.

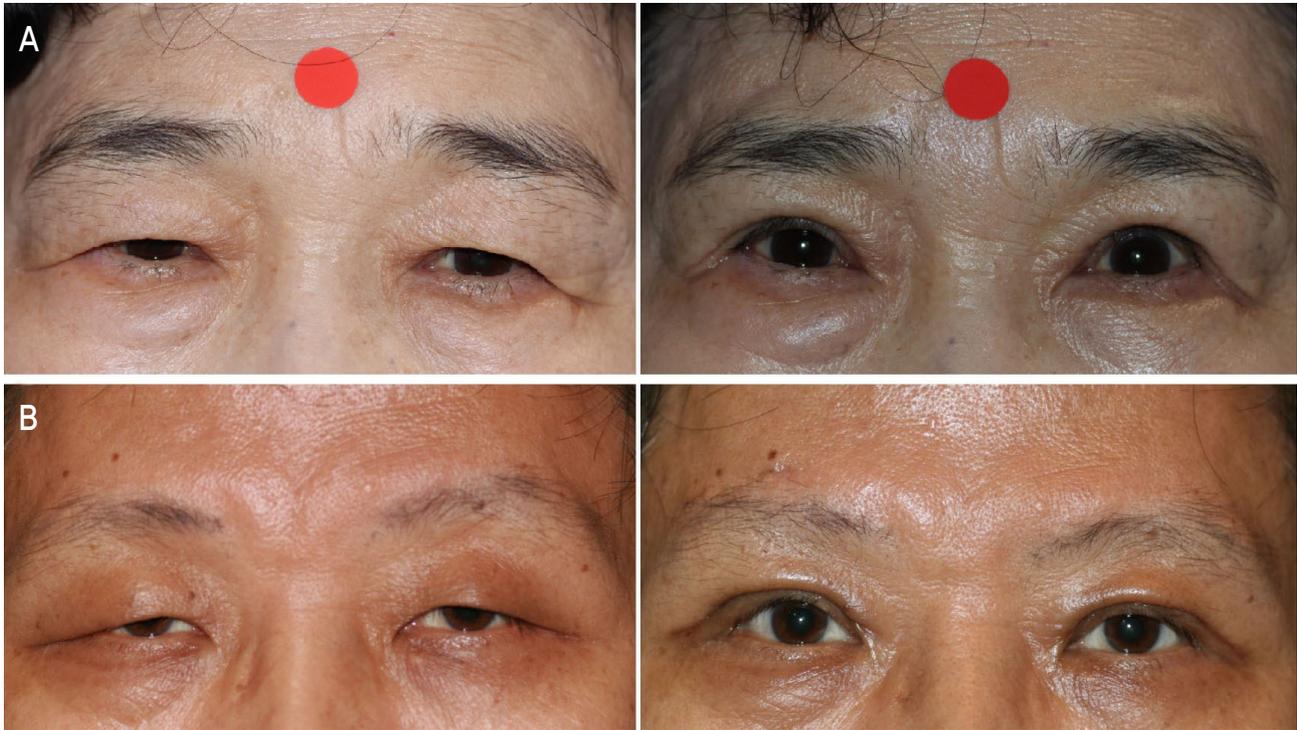


Figure 3. Preoperative (left) and postoperative (right) photographs. (A) A 69-year old female patient who underwent bilateral small-incision browpexy and blepharoplasty. Postoperative changes in BPD and BLCD are 0.57 and 0.98 mm in the right eye, and 0.81 and 1.63 mm in the left eye respectively. (B) A 55-year old male patient who underwent right unilateral small-incision browpexy and bilateral blepharoplasty. Changes of BPD and BLCD are 1.22 and 1.79 mm respectively. BPD = brow-to-pupil distance; BLCD = brow-to-lateral canthus distance.

coefficient and interclass correlation Pearson's correlation coefficient of the BLCD measurements were obtained to confirm the reliability of the measurement. Statistical significance was assessed at a significance level of less than 0.05.

RESULTS

Twenty-one eyes of 11 patients were followed for more than 6 months after surgery. The mean age of five males and six females was 67.2 years (standard deviation=5.7, range 55-73). Ten of the 11 patients received bilateral browpexy, and one underwent a unilateral browpexy due to asymmetric brow ptosis (Fig. 3). The mean preoperative BPD was 24.23 ± 3.06 mm, BMCD 24.80 ± 2.85 mm, and BLCD 25.40 ± 2.75 mm. Six months after surgery, the BPD was 25.33 ± 2.38 mm, BMCD was 25.02 ± 2.68 mm, and BLCD was 26.77 ± 2.63 mm. The difference in BPD, BMCD, and BLCD before and after surgery was 1.10 ± 0.89 mm, 0.20 ± 0.54 mm and 1.37 ± 1.04 mm, respectively. The pre-

operative and postoperative difference in BPD and BLCD were statistically significant ($p=0.009$, $p<0.001$), but that was not the case for BMCD ($p=0.477$) (Table 1). The intraclass correlation coefficient of the BLCD was 0.83 (95% confidence interval [CI] 0.79-0.87, $p<0.001$) and the interclass correlation coefficient was 0.67 (95% CI 0.62-0.72, $p=0.008$). During the follow-up period, there were no complications related to small-incision browpexy, and the scar was barely visible at the last follow-up visit.

DISCUSSION

Normal brow position is on the supraorbital rim for a male. In a female, it is slightly above the supraorbital rim and forms an arch.¹¹ As a human being ages, the soft tissue of the scalp and forehead gradually relaxes due to gravity.³ Eyebrow deflection is often seen first in the temporal eyebrows, which is less supportive by the deep tissue than in the medial eyebrows, and a selective force on the lateral side causes the lateral side to be droopier. Knize³ explained

Table 1. Comparison of preoperative and postoperative measured value of small-incision browpexy

	Preoperative	Postop. 6 months	Difference	<i>p</i> -value*
BPD (mm)	24.23 ± 3.06	25.33 ± 2.38	1.10 ± 0.89	0.009
BMCD (mm)	24.80 ± 2.85	25.02 ± 2.68	0.20 ± 0.54	0.477
BLCD (mm)	25.40 ± 2.75	26.77 ± 2.63	1.37 ± 1.04	<0.001

Values are presented as mean ± SD. Difference was defined as Postop. – Preoperative value.

BPD = brow to pupil distance; BLCD = brow-to-lateral canthus distance; BMCD = brow-to-medial canthus distance; Postop. = post-operative; SD = standard deviation.

*McNemar test.

this mechanism in three ways: 1) frontalis muscle resting tone, which supports the eyebrow medial to temporal fusion line; 2) gravity, which causes the soft tissue at the lateral side of the temporal line to slide over the temporalis fascia and pushes the lateral eyebrow downward; and 3) the hyperactivity of the corrugator muscle and the lateral orbicularis oculi muscle, which has an antagonizing effect against the frontalis muscle activity and directly pulls down the lateral eyebrow.

The eyebrow ptosis is quite often accompanied by blepharoptosis, and, since brow ptosis may be exacerbated after upper eyelid surgery, it is necessary to accurately evaluate the eyebrow ptosis before surgery. Consultation with the patient about the changes of the eyebrow that may occur after the operation and the necessity of the eyebrow lift in advance can increase the satisfaction after surgery.^{6,12,13}

Direct eyebrow lift is a method of dissecting the skin right above the eyebrow and resecting the skin and subcutaneous tissue in an oval shape. Although the effect of brow-raising can be obtained effectively in severe cases or facial paralysis, Booth et al¹⁰ has reported disadvantages such as scar formation and an unnatural eyebrow shape. A sensory change in the forehead has also been reported in 74% of the patients.

Internal browpexy that McCord and Doxanas¹¹ first reported is a method to fixate the flap to the eyebrows through a blepharoplasty incision. The skin scar is minimal compared to the direct brow lift, but the correction amount is relatively small, and brow ptosis can recur. Deep temporalis fascia or various materials has been applied to improve the efficiency.^{1,14-16} Internal brow fixation using Endotine[®] (Coapt Systems, Palo Alto, CA, USA), a bioabsorbable implant, has been performed effectively in patients with temporal brow ptosis.⁸ In general, the effect of brow raising is reportedly more than 2.0 mm for direct brow lift and about

0.9-1.7 mm for an internal browpexy^{1,7,17} although some reports denied any significant differences.² Internal browpexy has several disadvantages. Anchoring at the most inferior aspect of the brow can result the thick brow tissue to glide inferiorly over the point of fixation.¹⁰ The orbicularis muscle is more directly anchored to the periosteum and this may lead to skin wrinkling and decrease in brow mobility.¹⁵

Endoscopic brow lift has the advantage of not leaving a scar and improving the wrinkles in the glabella, but it can be accompanied by various complications.⁹ It can cause hemorrhage, hair loss at the incision site, and lagophthalmos. And if the supraorbital nerve is damaged, it may cause a temporary or permanent numbness on the forehead. In addition, if the temporal branch of the facial nerve is damaged, it may cause eyebrow paralysis. So, a thorough understanding of the anatomical structure and technique is required.

Massry⁶ reported his browpexy technique using one temporal incision. The technique lifts only the temporal brow, and a surprised or “Mephisto” appearance can develop. The authors tried to get a better eyebrow contour by making two incisions, one at the center and the other at the temporal brow. In addition, we wanted to quantitatively evaluate the lifting effects, and found that the brow center also had a boost effect.

Compared to previous published, small-incision browpexy has a similar browlift effect to that of internal browpexy, and it can also lift the center of the eyebrow. The procedure has several advantages. The scarring can be minimized by a small incision. Eliminating the need for dissecting the musculocutaneous flap which is performed in internal browpexy, shortens the operation time and the cost can be reduced by avoiding the use of materials such as Endotine[®]. In addition, anchoring at the superior aspect of brow can avoid the gliding of brow tissue over the point of fixation.

For the objectivity of the photographic analysis, the pre- and postoperative photographs were measured based on a reference point. We also tried to establish a high degree of objectivity through repeated measures and used the intra-class correlation coefficient and interclass correlation, and Pearson's correlation coefficient to check the error between measurements. In our study, the intraclass correlation coefficient was 0.83 ($p < 0.001$), which indicates that the reliability of the measurement is high. The reason for the higher number of inferior interrelationships (>interclass correlation, Pearson's correlation coefficient) compared to the interclass correlation coefficient is that the reliability of the values in the same patient is higher than the inter-patient reliability because it was measured based on the agreement of the preoperative and postoperative images in the same patient (>the preoperative and postoperative images in the same patient being matched). However, the inter-correlation coefficient also shows moderate reliability.

The significance of this study was to analyze the results of the small-incision browpexy through objective measurement, and it is thought that further study is needed in the future for more subjects and a longer period of follow up. We conclude that the small-incision browpexy is a minimally invasive method that minimizes scarring and can be performed in a short time in patients with mild brow ptosis without significant suprabrow skin redundancy.

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