A Conservative Crease-Height–Adjustable Asian Double-Eyelid Surgery Technique Based on Live Anatomical Studies

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Background: Ideal methods for double-eyelid crease creation in Asian upper eyelids remain controversial because of the complexity of the Asian upper eyelid anatomy. Key issues include the underestimation of tarsal height and the septum/aponeurosis fusion point height (FPH), which may underlie the unnaturally high creases in many classic double-eyelid procedures.
Methods: A total of 1272 patients had tarsal heights measured. Among 386 patients with orbital septa opened, FPHs and other anatomic findings were documented. Based on the anatomic findings, a novel method for double-eyelid crease formation was designed. This method involves preserving the pretarsal fibrofatty tissue and using horizontal mattress sutures to connect the orbicularis oculi muscle, through the pretarsal fibrofatty tissue and levator aponeurosis, to the pretarsal membrane (MAP method) as the linkage mechanism.
Results: Tarsal height levels were higher than reported in many previous studies. In the supine position, all FPHs were higher than the tarsi. Eyelid creases using the MAP method are created below the superior tarsal edges at varying heights, accommodating individual patient requests while achieving well-formed creases and improved eyelid mechanics. The recovery was brief, and the results were long-lasting with a minimal failure rate.
Conclusions: Tarsal heights and FPHs are not as low as previously thought, which could explain why many classic surgical procedures have various issues. The proposed MAP method for Asian double-eyelid blepharoplasty allows for conservative crease-height adjustability with results that are dynamic, natural, and durable. *(Plast. Reconstr. Surg.* 156: 29, 2025.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

Double-eyelid surgery is the most common cosmetic surgery performed among the Asian population.[1–3] The first double-eyelid surgery was reported by Mikamo[4] in 1896 using a simple suture method.[5] Over the following century, the surgery became increasingly aggressive, resulting in more Westernized eyelid appearances.[6–14] The classic techniques include the popular anchor method and the skin–tarsus–skin method, which use the upper tarsal edge as the anchor point for creating eyelid creases.[6,15–17] Because these methods use attachment of skin to the superior tarsal edge, and the tarsi have fixed heights, these techniques could result in eyelid creases that are static, unnatural, and positioned too high, and look unnatural for most Asian

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patients.[17–20] In addition, some procedures could interfere with eye opening.[16,17,21]

Many surgeons have advocated for preserving Asian ethnic features in recent years.[9,19,20] Chen[9] stated that ideal results require optimal placement of crease height, control of crease shape, natural continuous appearance, and achievement of permanence without long-term harm.[22] Obtaining these results is challenging, and necessitates that surgeons overcome technical challenges and have a thorough understanding of the unique anatomy of Asian upper eyelids.

Following reports of unusually high eyelid creases with classic methods,[6,15–17] we hypothesized that the fundamental issues might stem from misconceptions about Asian upper eyelid anatomy. We examined the tarsal heights and septum/aponeurosis fusion point height (FPH), along with other relevant structures (**see Animation, Supplemental Digital Content 1**, which shows key relevant anatomic structures of the eyelid, ***http://links.lww.com/PRS/H790***), and found that, in Asian upper eyelids, both tarsal heights and FPH are higher than many previously reported values.[13,23–26] On the basis of these findings, over the past 12 years, we developed a new crease-height–adjustable double-eyelid surgery technique using a linkage mechanism to connect the orbicularis oculi muscle (OOM), pretarsal fibrofatty tissue, distal aponeurosis, and pretarsal membrane, which we call the muscle, aponeurosis, and pretarsal membrane (MAP) method. Anatomical studies, techniques, and clinical outcomes are reported herein.

PATIENTS AND METHODS

This retrospective study followed the principles of the Declaration of Helsinki. A total of 4128 Asian patients underwent various upper eyelid surgical procedures from October of 2006 to March of 2023. Among them, MAP procedures were performed on 1579 patients from May of 2012 to March of 2023. Written informed consents were acquired. Statistics were performed with *t* test (Microsoft Excel).

Anatomical Studies

From March of 2012 to March of 2023, eye apertures, margin to reflex distance 1 (MRD1), and tarsal heights were gauged in 1272 patients (983 female AND 289 male patients; age range, 16 to 75 years; mean age ± SD, 38.02 ± 15.81 years). The apertures and MRD1 were determined in primary gaze with brows resting. Tarsal heights were evaluated on the operating table after eyelid eversion using a Desmarres lid retractor. (**See Video 1 [online]**, which shows execution of the single-window MAP technique.)

Tarsal heights were measured in situ from the superior tarsal edge to the gray line in supine position without eyelid eversion in 386 primary cases with bilateral orbital septa opened.[27] The FPH was also measured (**see Animation, Supplemental Digital Content 1**, ***http://links.lww.com/PRS/H790***). All measurements were made at the pupil line. (**See Video 2 [online],** which demonstrates key anatomic structures of the Asian upper eyelid.)

Other intraoperative anatomic observations were made during more invasive procedures, such as the anchor method, skin–tarsus–skin method, skin–aponeurosis–skin method, and levator aponeurosis repairs.[15,16,28–34]

MAP Double-Eyelid Creation

Consultations included listening to patient requests, followed by assessing their eyelid anatomy. Patients with levator function of less than 11 mm or eye aperture of less than 4.5 mm were excluded.

To determine the desired crease forms, heights, and pretarsal shows,[33,35] a paper clip was used to push against the upper eyelid at various heights in an upright position, with brows resting. In primary gaze, a crease would form. Patients looked into a mirror to decide the crease heights or pretarsal shows they preferred (Fig. 1). (**See Figure, page 1, Supplemental Digital Content 2**, which shows the evaluation procedure in a 32-year-old man presenting for double-eyelid MAP surgery, ***http://links.lww.com/PRS/H791***.) Any skin hanging over the desired pretarsal show was measured. The number thus obtained was doubled, resulting in the amount of skin removal needed.[35]

After oral sedation with 20 mg of diazepam, patients underwent surgery using local anesthesia (1% lidocaine with epinephrine). Crease heights were set at 3 to 5.5 mm above the gray line for most male patients and 5 to 7.5 mm above the gray line for most female patients (Fig. 1). Ptosis repairs were performed depending on patient consent.[33,34,36] Skin sutures were removed on day 7. Patients were informed about the possibility of brow decompensation and surgical failure; therefore, potential revisions were discussed.[37]

Mini-Incision Method

The mini-incision method was performed on 638 patients (mean ± SD age, 28.69 ± 7.91

Fig. 1. A 41-year-old woman evaluated for MAP double-eyelid surgery. (*Left*) With the brows in resting position, a paper clip was used to push against the closed upper eyelid at a 6.5-mm height from the gray line. (*Right*) A paper clip was used to push against the closed upper eyelid at a 7.5-mm height. With the eye open, a natural crease forms along the OOM fiber direction. Depending on the intended location of the crease, pretarsal show varies. The location of the paper clip on the skin is thus the incision height for double-eyelid crease formation. This patient preferred the eyelid form on the *left* side, reflecting that a wider crease was not desirable for her.

Fig. 2. A mini-incision pattern for MAP blepharoplasties. A single 4- to 5-mm incision through the skin only is presented (**see Video 1 [online]**). More comprehensive depictions of the various incision patterns are shown in the **Figure, page 2, Supplemental Digital Content 2**, ***http://links.lww.com/PRS/H791***. Photograph obtained from Shutterstock with a full license agreement.

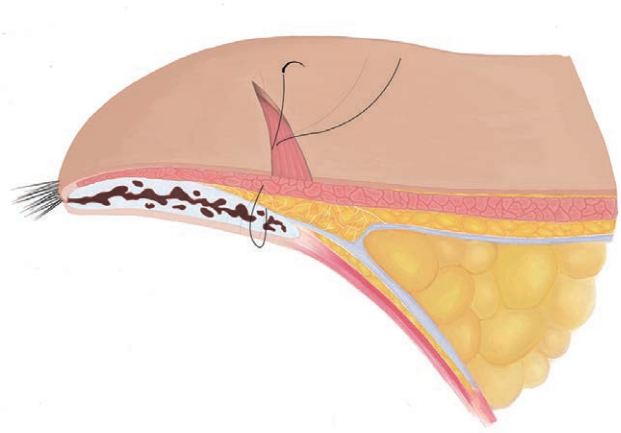

Fig. 3. The MAP method, with an OOM through the pretarsal fibrofatty tissue and aponeurosis to pretarsal membrane linkage. Image creation was inspired by Chen (Chen WPD. *Asian Blepharoplasty and the Eyelid Crease*. 3rd ed. Elsevier; 2016:57–58).

years) (Fig. 2). (**See Figure, page 2, *above*, Supplemental Digital Content 2**, which shows incision patterns for MAP blepharoplasties, ***http://links.lww.com/PRS/H791***.) Either 1 or 2 small incisions were made. After the OOM was exposed, a 7-0 Prolene suture (with a round needle) was pierced through the OOM, pretarsal fibrofatty tissue, and aponeurosis, engaging the pretarsal membrane (ie, the MAP method). The suture is then looped back to the OOM to complete a buried horizontal mattress suture (Fig. 3) (**see Video 1 [online]**).

When the skin or underlying tissue is thick, additional sutures can be positioned medially or laterally to enhance crease definition. This maneuver is also useful when aiming for slightly wider medial or lateral pretarsal shows. (**See Figure, page 2, *above*, *center*, Supplemental Digital Content 2**, ***http://links.lww.com/PRS/H791***. **See Video 3 [online]**, which demonstrates how to make the lateral part of the eyelid crease wider by using an 18-G needle hole, in addition to the central mini-incision.) When indicated, preaponeurotic fat was conservatively removed. (**See Video 4 [online]**, which illustrates the technique of both medial

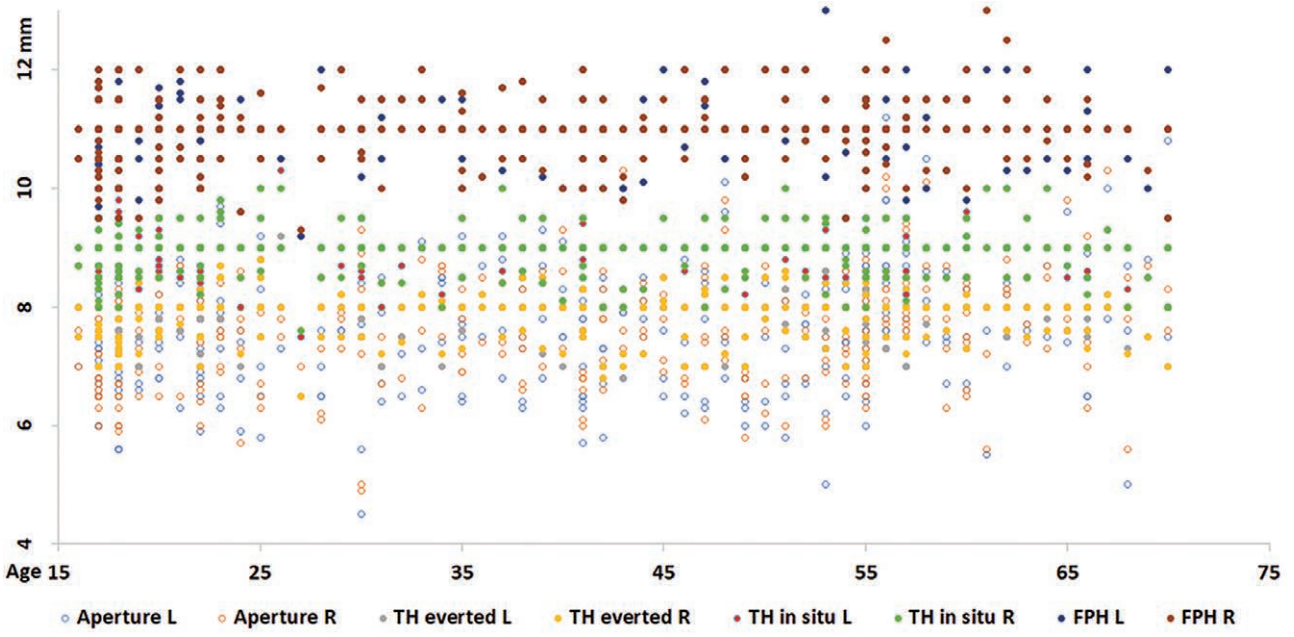

Fig. 4. Scatter graph of age and eyelid measurements of 386 patients who had eye apertures, tarsal height, tarsal height in situ, and septum/aponeurosis FPH assessed. The measurements for eye aperture were 7.62 ± 0.96 mm (*left eyelid*) and 7.68 ± 0.87 mm (*right eyelid*); for tarsal height, 7.92 ± 0.41 mm (*left eyelid*) and 7.92 ± 0.40 mm (*right eyelid*); for tarsal height in situ, 8.96 ± 0.39 mm (*left eyelid*) and 8.96 ± 0.38 mm (*right eyelid*); and for FPH, 10.95 ± 0.56 mm (*left eyelid*) and 10.95 ± 0.54 mm (*right eyelid*), respectively. Because the left and right values were similar, left-sided numbers are mostly covered by the right-sided numbers. Whereas eye apertures varied substantially, tarsal height, tarsal height in situ, and FPH remained relatively consistent. Ranges for the tarsal height and tarsal height in situ were 6.5 to 8.8 mm and 7.6 to 10 mm, respectively.

and central fat pad removal and the creation of a double-eyelid crease with the MAP technique.) The skin was closed with 7-0 Prolene sutures.

Full-Incision Method

The full-incision method was performed on 941 patients (age range, 43.18 ± 15.12 years) (**see Figure, page 2, below, Supplemental Digital Content 2**, ***http://links.lww.com/PRS/H791***). Excess skin was excised when indicated, but the OOM was not removed unless a heavy tissue burden existed. Conservative removal of preaponeurotic fat was performed as needed. The pretarsal fibrofatty tissue was preserved. MAP sutures were placed at 3 points (1 in the middle and 2 at the medial and lateral corneal limbi). (**See Video 5 [online]**, which showcases a full incisional MAP method for upper blepharoplasty.) The skin was closed with 6-0 nylon sutures.

Outcome Assessment

Patients were followed up for more than 6 months (mean ± SD, 17.01 ± 19.3 months). Patient satisfaction rating was performed in person (n = 1151) or by messaging (n = 382, with photographs) using the Global Aesthetic Improvement Scale.[38] Forty-six patients were lost to follow-up.

RESULTS

Anatomical Studies

The eye apertures were 7.70 ± 0.86 mm (mean ± SD; left) and 7.63 ± 0.85 mm (right), and the tarsal heights were 7.94 ± 0.35 mm (left) and 7.95 ± 0.34 mm (right).

Eye aperture, tarsal height, tarsal height in situ, and FPH values of the 386 patients with septa opened who had both tarsal height in situ and FPH assessed bilaterally are displayed in Figure 4. FPH was consistently higher than tarsal height in situ, aligning with previously published data.[27,39]

Our in vivo observations from more invasive procedures confirmed that pretarsal tissues are composed of pretarsal membrane, distal levator aponeurosis, pretarsal fibrofatty tissue, OOM, and skin. Contrary to some previous studies,[11–13] no orbital fat pad existed in this zone with patients in the supine position. No subcutaneous fat was evident in the pretarsal zone (**see Video 1 [online]**).

In addition, we verified that the distal aponeurosis is flimsy and elastic, and it is only attached to the tarsal structure near the gray line.[40,41] Behind the pretarsal aponeurosis is a tough membranous

Fig. 5. An 18-year-old woman who presented for correction of "small eyes" underwent mini-incision MAP surgery (Fig. 2). Levator function was 13.5 mm on both sides. The crease height was set at 6 mm. The tarsal height was 7.5 mm on both sides (**see Video 1 [online]**). The apertures were 6 mm on the left and 5.7 mm on the right before surgery and 7.5 mm on the left and 7.3 mm on the right after surgery. MRD1 values were 1.3 mm on the left and 1 mm on the right before surgery and 2.3 mm on the left and 2.1 mm on the right after surgery. The 23-month result is shown on the *right*.

Fig. 6. A 35-year-old woman with a left-sided multi-crease form and a right-sided single eyelid underwent mini-incision MAP surgery (Fig. 2). The crease height was set at 6 mm. The tarsal height was 8 mm on both sides. Levator function was 15 mm on the left and 16.5 mm on the right. The apertures were 7.8 mm on the left and 8.2 mm on the right before surgery and 8.2 mm on the left and 8.4 mm on the right after surgery. The MRD1 values were 2 mm on the left and 2.4 mm on the right before surgery and 2.3 mm on the left and 2.5 mm on the right after surgery. The 12-month result is shown on the *right*.

structure tightly attached on the tarsus.[40,41] The toughness of this membrane was confirmed when a 7-0 Prolene suture with a round needle was used to pierce through and engage this membrane. (**See Video 6 [online]**, which shows pretarsal anatomies, including the distal aponeurosis and the pretarsal membrane. **See Video 7 [online]**, which demonstrates the toughness of the pretarsal membrane when the MAP suture was placed for double-eyelid formation.) This pretarsal membrane is known to be the caudal continuation of Müller muscles.[40–45]

MAP Double-Eyelid Creations

Improvement in eye aperture and MRD1 occurred in many cases (Figs. 5 through 10). To assess this finding, we evaluated changes in single-eyelid cases after mini-incision MAP procedures (Fig. 10) to help eliminate confounding factors, such as removal of skin or OOM. Both eye apertures and MRD1 improved significantly ($P < 0.001$).

The satisfaction rate reported by patients for the MAP procedure was high (Table 1). A total of 67 patients reported being dissatisfied (Global Aesthetic Improvement Scale score 4 or 5). Crease failure occurred in 17 mini-incision procedures (16 bilateral) and 20 full-incision procedures (all bilateral), with most patients having apertures less than 6.5 mm or levator functions less than 13 mm. (**See Table, Supplemental Digital Content 3**, which presents the MAP procedure patient

Fig. 7. A 27-year-old woman presented with single eyelids containing rudimentary creases (2 mm) and pseudo multicreases from redundant skin accumulation (*above*). She had full-incisional MAP surgery and medial epicanthoplasty. Her eye apertures were 7.4 mm on the left and 7.2 mm on the right. Levator functions were 14 mm on the left and 14.3 mm on the right. MRD1 values were 2.3 mm on the left and 2.1 mm on the right. The tarsal height was 8.4 mm on both sides. The predetermined crease height was 7 mm. One year after surgery (*center*), the apertures were 9.5 mm; pretarsal shows, 3 mm; and MRD1, 3.9 mm on both sides. Twelve years later (*below*), the eyelid crease forms remained satisfactory, despite some signs of aging.

dissatisfaction report, ***http://links.lww.com/PRS/H792***.) None of these patients had ptosis repair. The crease failure times were all within the first 3 months after surgery.

In one case, we penetrated the conjunctiva while placing a MAP suture on one eyelid before initiating the examination of the tarsal height and tarsal height in situ. Other complications were rare. Suture spitting was identified in 5 patients (3 mini-incision, 2 full-incision), all within 4 months after surgery. All of these patients had thin skin, and removal of the spitting sutures did not affect double-crease forms.[4] No crease migration or blepharoptosis occurred. Patients typically had a short recovery time (2 to 4 weeks).

The mean tarsal height in situ 8.96 mm (approximately 1 mm higher than the tarsal height), with a range of 7.6 to 10 mm (Fig. 4). Meanwhile, the mean FPH was 10.95 mm—consistently higher than the tarsal height in situ—in agreement with the findings of many scholars.[16,46,47] The latter suggests that the septum/aponeurosis fusion point is not in the pretarsal zone and can be omitted in many conservative double-eyelid surgery designs. (**See Video 8 [online]**, which demonstrates our understanding of Asian upper-eyelid anatomy.)

DISCUSSION

Asian eyelid anatomy is complex and variable. (**See Figure, page 3, Supplemental Digital Content 2**, which shows patient photographs demonstrating different eyelid shapes, ***http://links.lww.com/PRS/H791***.) Most Asian eyelid anatomic studies have been conducted with small numbers of formalin-preserved or fresh-frozen cadaveric specimens from older decedents.[10–13,23–26] Both of these methods could cause tissue shrinkage from dehydration.[23,24] In addition, rigor mortis and subsequent loss of muscle turgor could alter fine anatomic structures.[48] As a result, conclusions from the studies are contradictory.[13,23–26,47] For example, some authors reported tarsal heights of 5 to 7.5 mm,[11–13,23–25] with the septum/aponeurosis fusion point located below the superior tarsal edge.[11–13,23,26,28] However, when the eyelid crease is set at the superior tarsal edge, it could become too high, as the tarsal height in situ in living patients per our study is 8.96 ± 0.39 mm (Fig. 4). This might explain some of the limitations in results of the anchor method or the skin–tarsus–skin method in double-eyelid surgical procedures.[6,8,15–17,28,29] Creases higher than 7.5 mm may not be desirable for many Asian patients.[49]

Newer techniques emerged using a skin–aponeurosis–skin linkage method.[16,28,30–32,41,50–54] Although good results are attainable, some specific techniques could result in static double eyelids.[11,51–56] Furthermore, based on our experience, the distal aponeurosis is rather flimsy and elastic (**see Video 6 [online]**), rendering the fixation unreliable.[57] With extirpation of the pretarsal fibrofatty tissue, crease migration (especially medially) could occur.[57–64] (**See Figure, page 4, Supplemental Digital Content 2**, which

Fig. 8. A 36-year-old woman had a history of failed double-eyelid surgery 16 years earlier. She showed faint crease forms and ptosis. Her eye apertures were 7.9 mm on the left and 8 mm on the right. The tarsal height was 8.2 mm on both sides. Levator functions were 13.8 mm on the left and 13.5 mm on the right. Mini-incision MAP surgery was performed through the old scars. Fifteen months after surgery (*right*), her apertures improved to 9.2 mm on the left and 9.4 mm on the right. MRD1 was also improved by 1 mm on both sides (from 2.5 to 3.5 mm). The creases were better defined and dynamic, and the new scars barely visible.

Fig. 9. A 25-year-old woman presented for treatment of eyelid asymmetry. She had consulted 3 surgeons before visiting us, all of whom told her that both eyelids need to be operated on to avoid shape discrepancy. The eyelid apertures were 9.2 mm on the left and 7.6 mm on the right. The tarsal height was 7.5 mm on both sides. Levator function was 14.5 mm bilaterally. MRD1 measurements were 3.5 mm on the left and 2 mm on the right. Mini-incision MAP surgery (Fig. 2) was performed only on the right side. Twelve months after surgery (*right*), the apertures were 9 mm and MRD1 3.3 mm on both sides. The creases are dynamic and the right upper-eyelid scar barely visible.

demonstrates skin–aponeurosis–skin linkage results, ***http://links.lww.com/PRS/H791***.) If the fixation hinges on the proximal solid aponeurosis, the creases could be too high, impeding eye opening.[16,54,65] (**See Figure, page 5, Supplemental Digital Content 2**, which demonstrates skin–proximal aponeurosis–skin linkage results, ***http://links.lww.com/PRS/H713***.)

Over the years, we have learned that the pretarsal fibrofatty tissue plays an essential role in maintaining the stability of the distal aponeurosis[17,64,66,67]; although it appears thick during surgery, it might simply be inflated by anesthesia fluid; after its extirpation, the distal levator aponeurosis (especially medially) may be unstable for suture fixation [17,40,41,68–70]; and resection can cause aponeurosis dehiscence and persistent pretarsal tissue swelling, because it has an abundance of lymphatics.[17,41,64,66,71,72]

In addition, in single eyelids, the distal aponeurosis could act as a "bungee cord" rather than a solid tendon, minimizing the lifting efforts by the levator muscles (Fig. 11, *center*) (**see Video 6 [online]**), which is in contrast to double eyelids with fibers extending from the aponeurosis to the OOM (**see Figure, page 6, Supplemental**

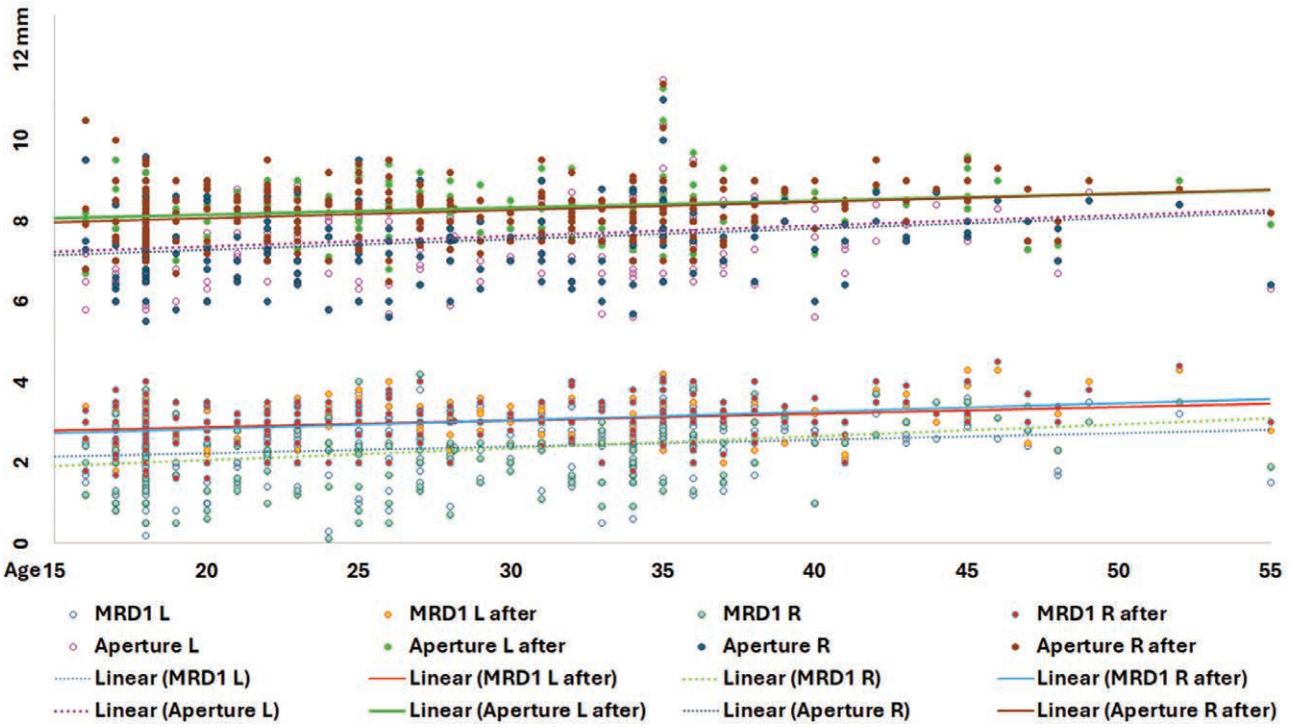

Fig. 10. MRD1 and aperture changes after mini-incision MAP in patients who underwent primary single-eyelid procedures (245 patients, with tarsal heights measured). MRD1 measurements (mean ± SD) were 2.37 ± 0.78 mm on the left before surgery, 3.01 ± 0.56 mm on the left after surgery, 2.3 ± 0.81 mm on the right before surgery, and 3.01 ± 0.56 mm on the right after surgery. Before surgery, the left apertures were 7.61 ± 0.92 mm and the right apertures were 7.51 ± 0.9 mm. After surgery, the apertures were 8.31 ± 0.68 mm and the right apertures were 8.25 ± 0.71 mm. The dotted trend lines represent *before* MAP surgical procedures; the solid trend lines, *after* MAP surgical procedures. MRD1 and aperture changes after surgery were all statistically significant ($P < 0.001$). The majority of patients were young and had small MRD1 and apertures.

Table 1. Outcome Assessment Score for MAP Procedures[a]

Score	Improvement	Result
1	Exceptional improvement	Excellent result
2	Very improved	Optimal improvement
3	Improved	Obvious improvement
4	Unaltered	Same as the original appearance
5	Worsened	Appearance worsened

[a]The total case number was 1579, with 46 patients lost to follow-up. Differences between mini-incision and full-incision patient scores (mean ± SD, 1.32 ± 0.74 versus 1.56 ± 0.90, respectively) are significant ($P < 0.001$) (modified from Global Aesthetic Improvement Scale score measurements [Savoia A, Vannini F, Baldi A. Radiofrequency waves with filling and peeling substances: an innovative minimally invasive technique for facial rejuvenation. *Dermatol Ther.* 2011;1:2–10]). Total patient score is 1.41 ± 0.82.

Digital Content 2, which demonstrates the difference between single eyelids and double eyelids in eye-opening actions, ***http://links.lww.com/PRS/H791***),[59,73] which limits the bungee cord effect.

The MAP sutures attach the distal aponeurosis to the OOM, with the pretarsal membrane included in the linkage mechanism (Fig. 3 and Fig. 11, *right*) This minimizes the bungee cord effect of the distal aponeurosis, correcting many cases of ptosis (Figs. 5 through 10). Also, with the MAP method, a double-eyelid crease can be fixed at any height on the tarsus (Figs. 5 through 9). Furthermore, because the OOM is included in the linkage mechanism, the resulting eyelid creases appear natural, aligning with the expectations of Chang et al.[55] and Chen.[56] The certainty of crease height and natural results also enables us to routinely perform single-sided eyelid surgical procedures with good matching ability (Fig. 9).

MAP suture placement is usually 3 to 7.5 mm above the gray line. Considering the range of tarsal height in situ being between 7.6 and 10 mm (Fig. 4), the MAP suture height ensures the safety of the procedure by preventing the needle from piercing through the conjunctiva above the tarsus. The minimal invasiveness and preservation of all tissue layers below the skin will also make any future upper blepharoplasty procedures less complicated.

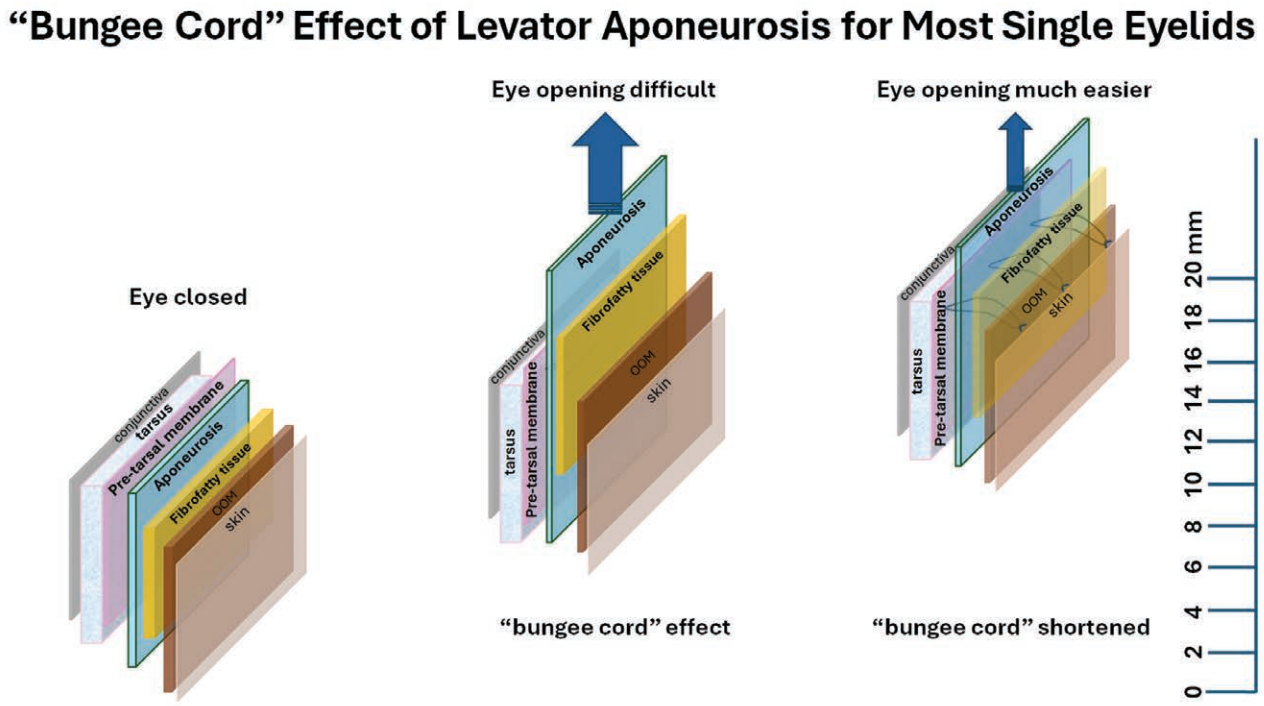

Fig. 11. Essential layers of the single eyelid. An effort to open the eyes causes the aponeurosis to stretch further, without effectively conveying levator function for eyelid opening. However, after MAP sutures are placed, the eyelid opens much more efficiently, due to shortening of the "bungee cord."

When suture spitting occurred, removal of spitting sutures did not affect the crease formation. This indicates that the cicatricial effect from the MAP suture placement could sustain the crease formation, similar to the first double-eyelid surgery by Mikamo,[4,5] in which the fixation sutures were removed on days 4 through 6, resulting in successful crease creation.

Patients with apertures less than 6.5 mm or levator function less than 13 mm had a higher crease failure rate. The fact that most crease failures were bilateral and that ptosis repair corrected all crease failures highlights that ptosis might be an important etiology for this complication (**see Table, Supplemental Digital Content 3,** ***http://links.lww.com/PRS/H792***). Nonetheless, many of our patients preferred not to have their ptosis repaired in order to preserve their original look.

Although the level of patient satisfaction was high, some patients were dissatisfied with their results (Table 1) (**see Table, Supplemental Digital Content 3,** ***http://links.lww.com/PRS/H792***). Some causes of dissatisfaction were attributable to issues with the surgical results; however, this population of patients tends to have specific desires related to the eyelid crease appearance, some of which may not be achievable with surgery.[74]

Similar techniques have been published, all of which require removal of the pretarsal fibrofatty tissue, with some cases showing partially depressed creases.[46,75–79] Wojno[64] suggested that the pretarsal fibrofatty tissue is an integral part of the pretarsal structure and should not be excised[66] (**see Video 8 [online]**). Furthermore, based on our experience, when pretarsal fibrofatty tissue is excised, it is difficult to keep the distal aponeurosis intact. The distal aponeurosis is so flimsy that it is impossible to separate it from the pretarsal fibrofatty tissue. In addition, because most methods emphasize pure single-incision windows,[46,67,75–79] the resulting crease forms may be suboptimal. In contrast, by using various eyelid incisions, we can treat Asian upper eyelids with different tissue conditions (**see Figure, page 2, Supplemental Digital Content 2,** ***http://links.lww.com/PRS/H791***), without the limitations common to other single-window methods.[46,75–79]

Use of the MAP procedure helped us achieve the 4 requirements reported by Chen[9]: optimal crease height placement; control of crease shape; natural appearance; and permanence without long-term harm. This is significant, as Chen[9] astutely observed that with current methods, it is impossible to achieve all these goals.

Many other double-eyelid surgery methods exist, some of which provide excellent results.[53,58,59,80–83] Due to our limited experience with these procedures, we cannot provide in-depth comments on them.

This study has some limitations. An obvious limitation is that the MAP procedure cannot be compared retrospectively with other double-eyelid surgery procedures due to lack of data collection. Moreover, we did not perform a prospective study, considering that other procedures could be suboptimal. Although significant ptosis correction occurred in many patients using the MAP method (Figs. 5 through 10), it did not manifest in some other patients. Therefore, we cannot provide a definitive report on this phenomenon. However, we found that most ptosis corrections occurred in the single-eyelid congenital ptosis group. We are using computer modeling to investigate this issue, with an emphasis on ptosis in Asian eyes.[36] A conjunctival penetration occurred in an early stage of this study, when we did not measure the tarsal heights. However, with the measurement of tarsal heights, it is safe to perform the MAP procedure without eye-shield protection. Nonetheless, when in doubt, eye shields should be used, especially for surgeons new to the MAP technique. It is also possible that in some patients, the MAP technique could have engaged part of the tarsus, instead of just the pretarsal membrane. When this happens, however, the result will not change, as the pretarsal membrane is almost as stiff as the tarsus.

It is important to note that various techniques could provide crease-height adjustability for Asian upper eyelid surgery.[46,75–79] Also, due to varying patient-specific requirements for crease heights and forms, it remains challenging to quantify satisfactory outcomes. In addition, we must acknowledge that this study reflects the experience of a single surgeon at a single institution.

More studies are needed to confirm our anatomic findings and the MAP method. A study using micro–computed tomography could help delineate microanatomies in Asian upper eyelids.[84]

CONCLUSIONS

We analyzed the upper eyelid anatomy of living Asian patients and found that measurements of the tarsal height and the FPH differ from many conventional findings. Based on the new findings, a crease-height–adjustable method for dynamic and optimally shaped double-eyelid crease formation—MAP—is described. This new method produces results that are natural, long-lasting, and tailored to individual patients' needs. The MAP procedure, which had minimal surgical complications, led to high patient satisfaction and improved eyelid mechanics.

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DISCLOSURE

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PATIENT CONSENT

Patients provided written informed consent for the use of their images.

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