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Oculoplastic Surgery

Levator Extension Method for Correcting Double Eyelids in Elderly Asian Patients: A Reliable and Flexible Blepharoplasty Technique

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Abstract

Background: Conventional tarsal fixation techniques for creating a static double-eyelid fold frequently result in a nonmobile overdepression of the fold, which is particularly pronounced in elderly patients.

Objectives: We propose a novel surgical approach aimed at achieving better results with fewer complications. This approach involves imitating the natural double-fold physiology by employing a turn-over flap of the orbital outer septum and carefully managing the pretarsal soft tissue to create a double fold.

Methods: A total of 503 patients underwent double-eyelid surgery, involving a turn-over flap of the outer orbital septum and pretarsal soft-tissue management. The orbital septum was exposed and transversely opened superior to the incision margin and the pretarsal soft issue was removed as necessary. Turn-over flaps were trimmed and attached to the dermis and orbicularis oculi muscle of the lower flap. Patient follow-up occurred for 2 to 7 years (mean, 3.8 years).

Results: This surgical method achieves a double fold with shallow or moderate depth, creating a natural-appearing fold line. Of the 503 patients, 94% of respondents provided a satisfaction score of 4 and 5 points; 20 people provided a score of 3 points; 10 were dissatisfied. A review of the patient chart showed that there were no specific complications in >94% (473) of patients.

Conclusions: We proposed a double-eyelid surgery technique using the outer septum to control the depth and pretarsal soft-tissue management to minimize resistance in the creation of the double eyelid. Our method showed a high patient satisfaction rate and fewer complications in elderly Asians.

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Natural double eyelids occur because of the expansion of the levator aponeurosis into the orbicularis oculi muscle, connecting to the dermis and forming a lid crease. In Asia, approximately 50% of people have double eyelids, and upper eyelid blepharoplasty is the most frequently performed surgery.[1,2]

Upper eyelid blepharoplasty procedures can be classified as either incisional or nonincisional methods.[2] The incisional method usually involves the excision of the excess skin of the upper eyelid and fixation of the double eyelid

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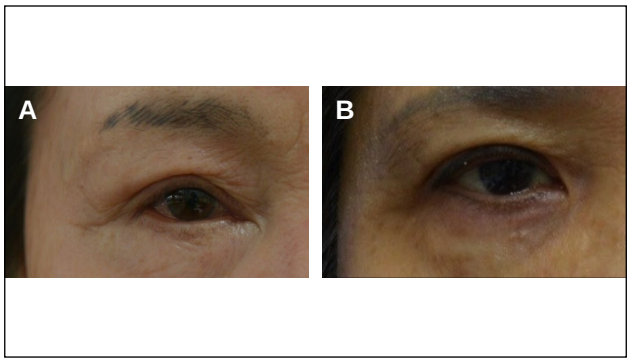
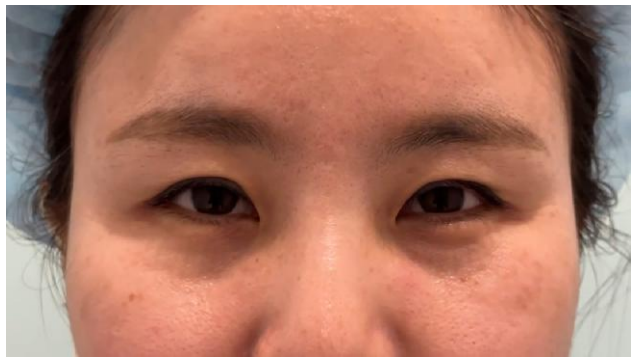


Figure 1. (A) A 70-year-old female patient who underwent upper eyelid blepharoplasty by the conventional tarsal fixation technique is shown 1 year postoperatively. (B) Eight-month postoperative photographs of a 61-year-old female patient who underwent upper eyelid blepharoplasty by the conventional tarsal fixation technique in the past; this surgery resulted in a strong and sharp appearance.

Video 2. Watch now at http://academic.oup.com/asjopenforum/article-lookup/doi/10.1093/asjof/ojad101

by adhesion to the incision line. However, the selection of the area responsible for eyelid elevation and securing the lower flap in double-eyelid formation have been long-standing topics in blepharoplasty. The conventional tarsal fixation technique creates a static double fold that fixes the dermis of the lower flap to the tarsus.[3] In addition, alternative methods have been devised, such as fixing the dermis or orbicularis oculi muscle of the lower flap to the upper part of the tarsus, levator aponeurosis, orbital septum, or the thickening of the septoaponeurotic junction (SAJT).[2,4-10]

The most commonly performed method, the tarsal fixation technique, frequently results in excessive pretarsal soft tissue and fixation to the posterior structures. Therefore, it is at times easier to create a deep and unnatural eyelid fold in elderly Asians. However, this method is likely to create a strong and sharp appearance in older patients due to the excessive depth of the fold (Figure 1 and Video 1, available online at www.aestheticsurgeryjournal.com).



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In Asia, most elderly patients prefer a shallow-to-moderate double-eyelid fold because they do not desire a drastic change of appearance following surgery. A dynamic fold with moderate depth is considered to be more suitable and natural-looking for older Asians (Video 2, available online at www.aestheticsurgeryjournal.com).

To overcome some of the limitations of the currently performed methods, we developed a technique that uses the turnover flap of the outer orbital septum and appropriate pretarsal soft-tissue excision. When considering the natural double-eyelid physiology, it is favorable to use mobile tissue, which is thinner and more pliable, to connect the lower flap and the levator complex. When the eyes are open, the levator complex pulls the outer orbital septum, and the fold occurs. This surgical method creates a double eyelid by opening the orbital septum and fixing the thin and pliable outer septum to the dermis and orbicularis oculi muscle of the lower flap as an extension of the levator complex. Therefore, the purpose of the authors of this study was to introduce a new method of performing eyelid surgery and to determine its effectiveness and safety.

METHODS

This study was a retrospective review of surgeries performed by 2 experienced surgeons. Between January 2015 and January 2020, 503 patients without blepharoptosis underwent treatment using the incisional method, involving the fixation of the flap using the outer orbital septum. The patients were observed over a 1-year follow-up period. Patients were excluded if they underwent surgery during this period by a method other than that included in the present study or if the follow-up period was shorter than 1 year. Of these, 258 patients underwent medial epicanthoplasty simultaneously. This study was approved by the Institutional Review Board (IRB No. P01-202107-21-021) of Public Institutional Review Board Designated by the Ministry of Health and Welfare, Korea National Institute For Bioethics Policy. All procedures

Video 3. Watch now at http://academic.oup.com/asjopenforum/article-lookup/doi/10.1093/asjof/ojad101

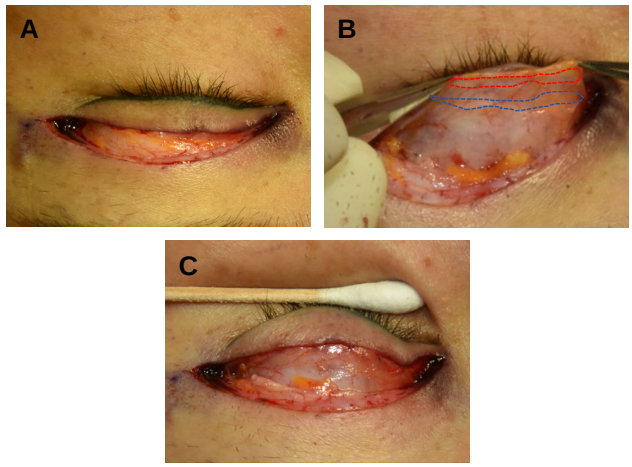

Figure 2. Intraoperative photographs of a 57-year-old female patient. (A) Only the skin is removed using Metzenbaum, and the orbicularis oculi muscle is uniformly removed near the lower flap horizontally under the removed skin. (B) The turn-over flap of the outer orbital septum (upper dotted line) is attached to the septoaponeurotic junction (lower dotted line). The turn-over flap of the outer orbital septum is extended, and the tension reaching the dermis of the lower flap is checked. (C) The extended septal flap is fixed with the outer septum, including the dermis and part of the superficial layer of orbicularis oculi muscle, using 7-0 nylon. Seven- to 8-point fixation sutures were made from the medial to the lateral corner of the upper eyelid.

followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the study.

Surgical Technique

Preoperative design was performed with the patient either lying down or in a seated position before surgery (Video 3, available online at www.aestheticsurgeryjournal.com). The operation was performed under intravenous anesthesia before administering local anesthesia using 2% lidocaine (1:100,000 epinephrine). This anesthesia was administered through an injection needle, which was carefully inserted from the lateral corner of the eye and shallowly injected into the dermis and orbicularis oculi muscle using the infiltration technique. Care was taken not to anesthetize the levator complex by inserting the injection too deeply.

A size 15 blade was used to make an incision on the skin according to the design pattern, with careful adjustment of the depth to ensure that only the skin layer was incised. The skin was removed using Metzenbaum surgical scissors, and the orbicularis oculi muscle near the lower flap was uniformly trimmed horizontally from under the removed skin. A portion of the orbicularis oculi muscle was removed based on skin thickness; thicker skin required more removal and thinner skin required less removal (Figure 2A). The area close to the upper incision line was removed conservatively, because failure to do so may cause a triple fold.[11]

The orbital septum was carefully opened at the predetermined location where it was expected to turn over and extend. If the orbital septum was opened too high, trimming of the outer septum would be needed. If the opening was too low, excessive tension of the lower flap would occur.[6] The conjoined part of the septum and aponeurosis is low laterally, and relatively high medially; therefore, care should be taken to avoid damage.[12] The septoaponeurotic artery is in the lateral area; therefore, the opening should be made carefully to avoid bleeding,[13] because this can be difficult to stop. Moreover, the hematoma of the Muller muscle may cause medial ptosis and excessive swelling of the lower flap. Orbital fat was removed conservatively; however, if medial fat bulging was present during preoperative evaluation, it was needed to be removed. When performing this step, careful hemostasis was performed using electrocautery.

After the orbital septum was opened, the tissue in front of the tarsal plate was trimmed appropriately to create space for the outer septum to be turned over and the lower flap to be easily folded (Figure 3). This process is essential for this operation, because if not performed, it can result in the loss of the fold. The turn-over flap of the outer orbital septum was then extended and the proper tension between the dermis and the orbicularis oculi muscle of the lower flap was established. If the distal part of the outer septum was too loose, it was trimmed. At this time, in cases with strong resistance to double eyelid formation, such as young patients or patienst with thick skin, fixation is performed using an external septum close to SAJT (Figure 2B).

The extended turn-over flap of the outer orbital septum was fixed to the dermis and part of the superficial layer of the orbicularis oculi muscle, using 7-0 nylon sutures. Seven- to 8-point fixation sutures were made from the

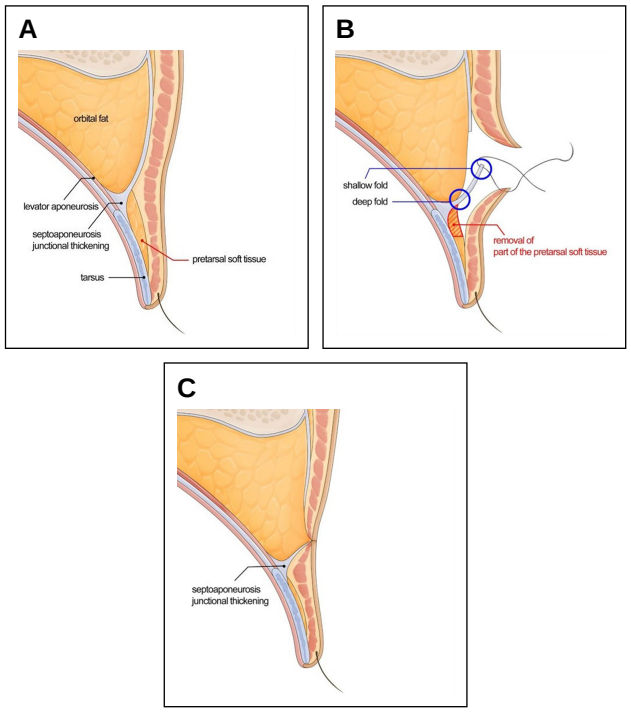

Figure 3. (A) Anatomy of an Asian upper eyelid without a double fold. (B) Turn-over flap of the anterior septum was elevated. Depending on the length of the turn-over flap, the depth of the double fold can be adjusted. Presarsal soft tissue is removed for reducing the resistance of the double fold. (C) Turn-over flap of the anterior septum is sutured with the dermis or orbicularis oculi muscle of the lower flap.

medial to the lateral corner of the upper eyelid (Figure 2C). In the conventional tarsal fixation method, usually 3 to 4 points are sutured, because the tarsus is a hard structure compared with the outer orbital septum. Because of the soft and pliable nature of the outer orbital septum, it requires more suture sites to ensure the preservation of the fold. In older patients, it is recommended to add 1 point for the natural extension of the lateral double fold. If only the orbicularis oculi muscle under the dermis is sutured with the septum, the double-eyelid line will be lower than the incision line, which can lead to irregularity.

After completing the fixation suture of the lower flap to the outer orbital septum, the dermis of the upper and lower flaps and the outer orbital septum were used to make 4 guiding sutures. A skin-to-skin suture was subsequently performed with a continuous suture.

RESULTS

Patient Demographics

A total of 503 patients were included in the study (423 females and 80 males; mean age, 53.5 years; Table 1). The evaluation criteria were based on loss of fold, asymmetry, and patient satisfaction. Consecutive measurements were taken at 1 and 2 years postoperatively. The follow-up period ranged from 2 to 7 years (mean, 3.8 years).

Table 1. Demographic Data of the 503 Patients Included in the Study

Characteristic	Value (%)
Sex	
Female	423 (84%)
Male	80 (16%)
Mean age	53.5
Group A (<50)	213 (42.3%)
Group B (≥50)	290 (57.7%)

Patient Satisfaction

At the 2-year follow-up after surgery, patient satisfaction with the surgery was evaluated. Satisfaction was scored on a 1- to 5-point scale, with 1 being very dissatisfied and 5 being very satisfied. A total of 473 (94%) patients stated that they were satisfied, including 237 (47.1%) patients with a score of 4 and 236 (46.9%) with a score of 5. Of the remaining patients, 20 provided a score of 3, and 10 were dissatisfied with the results (9 with a score of 2 and 1 with a score of 1; Table 2).

Complications

A review of the patients' charts showed no specific complications in more than 94% (473) of patients. Partial and complete fold losses occurred in 1.7% (9) and 0.4% (2) of patients, respectively, and 3.7% (19) of the patients showed an asymmetric fold of 1 mm or more that required surgical correction. In an earlier surgery, 1 patient developed excessive eyelash eversion. Surgery was not performed on this patient because significant improvement was observed in the first year of follow-up (Table 3).

Loss of Fold

Based on age, the patients were divided into Groups A (20-50 years) and B (50-70 years). There were 2 and 7 cases of total and partial releases, respectively, in Group A, and 2 cases of partial release in Group B. The number of cases in Group A (4.2%) was approximately 3 times that of Group B (0.6%); however, the difference was not statistically significant ($P = .190$; Table 4).

Table 2. Patient Satisfaction With Surgery ($n = 503$)

Satisfaction score	Very unsatisfied (1)	Unsatisfied (2)	Neutral (3)	Satisfied (4)	Very satisfied (5)
n (%)	1 (0.2)	9 (2.1)	20 (3.9)	236 (46.9)	237(47.1)

Table 3. Complications in the 503 Patients

Complication	% (Cases)
No complications	94% (473)
Asymmetric fold	3.7% (19)
Fold loss: partial	1.7% (9)
Fold loss: complete	0.4% (2)

Table 4. Fold Loss Rate According to Age During Surgery

Age (years)	No. of patients (*n*)	Fold loss, *n* (%)
<50	213	9 (4.2%)
≥50	290	2 (0.6%)

$P = .190$, χ^2 test.

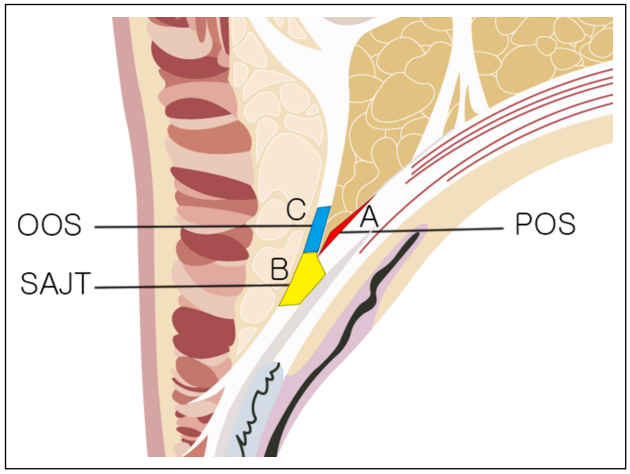

Figure 4. Posterior orbital septum (A), septoaponeurotic junctional thickening (B), and the outer orbital septum were identified as surrounding tissues connected to the levator complex (C). OOS, outer orbital septum; POS, posterior orbital septum; SAJT, septoaponeurotic junction.

Asymmetry

A total of 19 cases of asymmetry required surgical correction. The difference in the height of the lower flap is an important factor that can determine the asymmetry of the double eyelid. In contrast to fixing the lower flap to a fixed, static structure, such as a tarsus, the size of the lower flap may be unintentionally different due to the difference in tension when the lower flap is sutured to the turn-over flap of the outer orbital septum. Therefore, the trimming of the flap requires careful attention to ensure that both sides have the same tension.

Eyelash Eversion and Ectropion

Excessive trimming of the turn-over flap of the outer orbital septum may cause excessive eyelash eversion. If excessive eyelash eversion is observed when the eyes are opened after septodermal fixation, this could be resolved by adopting a more distal suture site for the turn-over flap of the orbital septum, or by using an alternative fixation method such as 3-point fixation.[10] Eyelash eversion or ectropion was not observed in any patient during the follow-up period.

DISCUSSION

In natural double eyelids, the septum fuses with the anterior layer of the levator aponeurosis above the tarsus. Variable attachment sites have been reported, extending from 0 to 10 mm from the upper margin of the tarsal plate. Among Asian populations, this fusion point can be very low or absent, resulting in the so-called single eyelid.[11] Additionally, it contains a greater amount of submuscular tissue and preaponeurotic fat extending into the pretarsal area.

Hwang et al reported that the orbital septum originates from the arcus marginalis of the frontal bone and constitutes 2 layers: the whitish outer (superficial) septum, which interdigitates with the levator aponeurosis through loose connective tissue and disperses downward, and the inner (deep) septum, which is superficially located in the levator aponeurosis and extends upward to the Whitnall ligament.[14] With regard to the orbital septum, Kakizaki et al proposed that the anterior orbital septum merges with the aponeurosis to form a conjoined fascia.[15] However, the levator aponeurosis was described to comprise anterior and posterior layers, with the anterior layer connected to the orbital septum. This connection is believed to correspond to the same area as the inner septum, as revealed by Hwang et al. The outer and inner layers of the septum fuse at the distal levator aponeurosis, anterosuperior to the tarsal plate, which Kim et al have named as the SAJT.[6]

As described above, the outer septum (anterior), inner septum (posterior), and SAJT (Conjoined) were identified

Figure 5. (A) Preoperative view of a 56-year-old female patient, and (B) postoperative view at 2 years after double-eyelid surgery with the levator extension method using the outer septum.

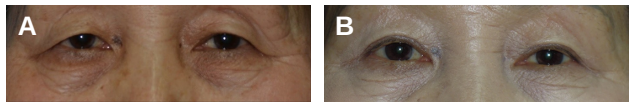

Figure 6. (A) Preoperative view of a 70-year-old female patient, and (B) postoperative view at 2 years after double-eyelid surgery with the levator extension method.

as surrounding tissues connected to the levator complex and can be used to transmit elevation force[6,12,14] (Figure 4). The question of which structure in a region involved in eyelid elevation should be used to fix the lower flap for double-eyelid formation has long been debated in blepharoplasty. Several similar articles have been published regarding the use of surrounding tissue connected to the levator complex for fixing the lower flap.

After Flower reported that the posterior septum vehicle could be used for double-eyelid formation,[9] the surgical method using the septum has been refined by several authors. Lee et al published a thesis on septodermal fixation with or without septum opening.[7] Chung et al refined this study by including dermal fixation of the septoaponeurotic union after the opening of the anterior septum to obtain good results.[8] However, this technique led to a loss of fold in many cases following long-term follow-up.

The surgical method in our study is similar to the method described in the above study because it performs dermal fixation by turning over the pliable outer septum connected to the levator complex. However, it differs from existing techniques in the literature because septodermal fixation is dependent on the proper removal of the pretarsal tissue. We believe that an appropriate excision of the pretarsal soft tissue can reduce fold loss in surgeries using a turn-over flap of the outer orbital septum. This is attributed to the fact that the folded turn-over flap can be accommodated in the space created, by removing the appropriate soft tissue, thereby reducing the resistance of the double eyelid.[2]

Kim et al applied SAJT fixation to the lower flap using a dense conjoined area formed by the meeting of the septum and levator aponeurosis.[6] The SAJT lies in between the outer layers of the orbital septum and the levator aponeurosis, and at the proximal end of the septal extension.[6]

Kim et al described the advantages of using the turn-over flap of the outer orbital septum as compared to dermal fixation to the SAJT, because it allows more dynamic control during the trimming of the distal part. For example, if the lower incision line is low, the length of the turn-over flap of the outer orbital septum can be controlled to adjust the depth of the double eyelid and the height of the lower flap. In addition, because the turn-over flap of the outer orbital septum is pliable and thin, it does not directly transmit the elevation force to the dermis, allowing the depth of the double eyelids to be shallow. Eyelash eversion occurred less when this technique was used as compared to when SAJT fixation was used, especially in older patients.

In 2018, Li et al published a paper detailing the fixation of the orbicularis oculi muscle using a downward-turned orbital septum.[16] In our experience, this method can lower the double-fold line because of adhesions occurring below the incision line. In addition, natural double eyelids consist of fibrous extensions from the levator aponeurosis to the dermis or orbicularis oculi muscle. In Asians, the resistance to the double-eyelid formation is usually strong; as a result, creating adhesions directed toward the dermis may help minimize double-eyelid loosening.

Our surgical method has a significant advantage for patients who desire a high double-fold height. The size of the tarsal plate is smaller in Asians than in others; it is approximately 9.3 mm at the central point.[17] Therefore, if the lower incision line is planned higher than the tarsal plate, the double eyelid would look unnatural because the pretarsal fullness increases in the tarsal fixation technique. Furthermore, when performing upper blepharoplasty in elderly patients, the amount of skin excision is likely to be substantial. In this case, the thin dermis of the lower incision line and the thick dermis of the upper incision line meet, and the difference between these 2 makes the upper eyelids look unnatural after surgery.[18] Although reducing the amount of skin resection by raising the lower incision line can be a solution, we need to ensure that the height of the lower incision line cannot be higher than the tarsal plate when it is fixed to the tarsal plate. However, the conjoined area always exists above the tarsal plate; therefore, our method has fewer limitations as compared to the fixation method that uses the tarsal fixation technique. Additionally, it can produce a natural double-fold line that is positioned at a higher level than the tarsal plate, without excessive depth (Figures 5, 6). However, the turn-over flap of the outer orbital septum is a pliable and thin tissue; therefore, if it is not fixed to the dermis by trimming with appropriate tension, or if the soft tissue in the pretarsal area is not well managed, fold loss can easily occur.

Tension control between the outer septum and the lower flap should differ between young and older patients. Excessive trimming of the distal part of the lower flap can lead to increased tension and result in a larger lower flap with a deeper double eyelid. Conversely, weak tension can cause the lower flap to be smaller than desired, leading

to shallower and less stable double eyelids. Therefore, young patients with thick skin or patients with a strong resistance to double-eyelid formation may require more trimming to achieve nearly 90° eyelash eversion and stronger fixation. However, for elderly patients, because the skin is usually thin and the resistance of the double eyelids is weak, the outer septum is stretched and fixed to the lower flap without tension.

Another important factor influencing the stability of the double eyelids is the proper removal of pretarsal tissue. If the pretarsal tissue is excessively removed, iatrogenic ptosis may occur, and if it is not removed evenly, the double-eyelid line may present uneven. Because our method is not a fixation method that uses a tarsal plate, care must be taken not to create an asymmetric fold during surgery. To reduce the asymmetry of the double eyelids after surgery, it is necessary to recognize the difference in the size and position of the patient's orbit and eyeball before surgery, the functional differences in the levator muscle, and the difference in the drooping of the skin due to the position of the eyebrows. Furthermore, instead of solely compensating for the variation in skin resection between both eyelids, it is more effective to address this issue through a combination of skin resection adjustment and fine-tuning the height of the lower incision during the design phase. For example, if there is more skin drooping due to eyebrow ptosis in 1 eye, the lower incision line of that eye must be raised and the amount of skin to be excised appropriately altered.

Based on the results of long-term follow-up regarding the use of the outer orbital septum as an extension of the levator complex, the loosening rate of the double fold was found to be approximately 3 times higher in the young patient group than in the older patient group; however, there was no statistically significant difference ($P = .190$; Table 4). In the older patient group, dermal atrophy and subcutaneous fat decreased with age, resulting in less resistance to the double-eyelid formation, which was thought to have affected the loss of the double fold.[19] Another possibility is the difference in the choice of a surgical method for the patient. That is, young patients with a low resistance to double fold prefer the nonincisional method, whereas patients with a high resistance to double fold prefer the incision method. However, elderly patients with a low resistance to double-eyelid formation usually choose the incisional method to remove drooping skin, whereas those with high resistance usually choose other surgical methods such as subbrow excision and endoscopic brow lift. Moreover, because there was continuous follow-up and chart review of patients, the probability of postoperative complications was higher, because patients with complications tend to actively participate in follow-up care, whereas patients without problems often do not participate in follow-up.

The limitations of our study include an extended learning curve stemming from the incorporation of pliable soft tissue in the surgical approach. This extended learning curve may contribute to a higher incidence of adverse events in patients who do not achieve the desired outcomes. In addition, in our study, we calculated the probability of fold loss with age, but we did not evaluate the characteristics and resistance of each patient's eye separately. If these factors are considered and evaluated, there may be more scope to provide a successful surgery tailored to each individual patient.

CONCLUSIONS

Various fixation methods have been introduced to achieve double eyelids through incisions. Among these, good results were obtained by mimicking the natural physiology of the double eyelid by extending the outer septum and connecting it to the levator complex. Based on the results of a long-term follow-up, it was confirmed that the loosening rate of the double fold was lower in senile patients than in younger patients. In conclusion, double-eyelid surgery using the turn-over flap of the outer orbital septum was a useful method with fewer complications and a good appearance.

Supplemental Material

This article contains supplemental material located online at www.asjopenforum.com.

Acknowledgments

Drs Han and Choimade made an equal contribution to this work as co-first authors.

Disclosures

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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