Aesthetic Surgery Journal
2019, Vol 39(12) 1284–1294

DOI: 10.1093/asj/sjz077
www.aestheticsurgeryjournal.com
OXFORD
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Preliminary Report

"Dynamic Canthopexy" Drill Hole Canthal Repositioning

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Abstract

Background: Canthopexies can be performed to modify the eye slant, both when the lateral canthus is lower than the medial one (congenital defect) or in case the patient asks for an almond-shaped eye (cosmetic indication).

Objectives: This peculiar type of canthopexy can be defined as "dynamic canthopexy," meaning that the lateral canthus is released from its original insertion and raised to a higher position. The goal of this study is to demonstrate the differences and the efficacy of the dynamic cantoplasty.

Methods: The authors reviewed 30 patients treated with a "dynamic canthopexy" between January 2005 and March 2015. Eighteen patients were affected by true downslanting palpebral fissure, and 12 patients had a normal eye shape but were wishing for a more "Asian" look. Dynamic canthopexy involves a total modification of the canthal suspension system and its careful reconstruction at a higher level inside the orbital rim. To obtain a permanent result, canthal ligament and tendon had to be anchored to drill holes in the orbital rim bone with nonabsorbable sutures. Symmetry was very carefully assessed. The average surgical time was 1 hour.

Results: This surgery proved extremely effective in all cases. Patients must be warned, though, that an initial hypercorrection is necessary to achieve the desired canthal position. About 6 months after surgery the result of this operation can be considered permanent. Severe complications are rare.

Conclusions: Dynamic canthopexy can provide stable correction of anti-Mongolian slant. It can also be effectively employed to obtain permanent slant eyes when required by purely cosmetic patients. If precisely carried out, this technique can yield very rewarding outcomes.

Level of Evidence: 4

Editorial Decision date: March 6, 2019; online publish-ahead-of-print March 15, 2019.

The position and shape of the lateral canthus greatly influence the aesthetic appeal of the eye. Lower-eyelid laxity and lateral canthal dystopia are common signs of facial aging and of congenital, iatrogenic, and posttraumatic conditions; the practitioner must address these deformities to achieve a pleasing eye shape. Aesthetic surgeons who treat

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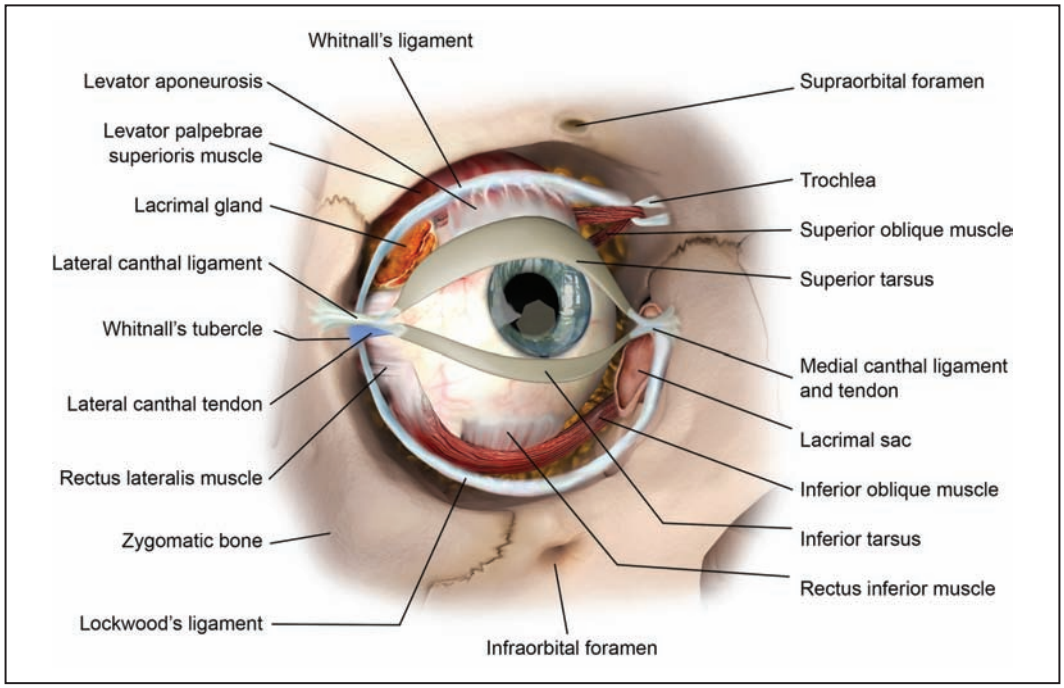

Figure 1. The eye and surrounding structures. The canthal tendon attaches to Whitnall's tubercule, which is situated on the interior face of the orbit approximately 5 mm posterior to the lateral orbital rim. The canthal ligament is superficial to Whitnall's tubercle and merges with the periosteum of the orbital rim immediately beneath the orbicularis.

the eyelid area should be familiar with canthal-anchoring techniques (ie, canthopexy and canthoplasty). Specifically, canthopexy can improve the appearance and stability of the canthus.[1-3]

Herein, we categorize canthopexy procedures as either static or dynamic. Static canthopexy involves strengthening the suspension system of the eyelid without altering the original position of the canthus. This may be accomplished by plicating the canthal ligament or by sectioning, shortening, or repositioning the ligament and sometimes the tendon.[4-7] Indications for static canthopexy are age-related lower-eyelid laxity with palpebral margin malposition (characterized by scleral show, lateral bowing, and ectropion) or secondary (posttraumatic or iatrogenic) dislocation of the lower-lid margin and/or the lateral canthus.

In dynamic canthopexy, the position of the lateral canthus is modified—usually by lifting it a few millimeters—and the local anatomy is altered by releasing and repositioning the support structures.[8] Dynamic canthopexy is suitable for patients with a congenital "downslanting palpebral fissure" (ie, lateral canthus >2 mm below the medial canthus) or for those who request almond-shaped eyes solely for cosmetic reasons. In our experience, dynamic canthopexy is rarely indicated because few patients of European descent have downslanting palpebral fissure. Prior to treatment, Caucasian patients who request modification of the eye to an almond shape should undergo psychological screening to verify whether they are fit for this procedure.

The suspensory lateral-canthal system can be divided into 3 components.[9-20] The first is the retinaculum, a group of structures in the deep posterior lamella. The retinaculum includes the lateral canthal tendon, which connects the lower tarsus to the inner part of the orbital rim at the level of Whitnall's tubercle (Figure 1). At this same level, the lateral horn of the levator, Lockwood's ligament (in most cases), Whitnall's ligament, and the lateral extension of the capsule-palpebral fascia are inserted. The second, intermediate component is the middle lamella, which entails the canthal ligament, a thick part of the eyelid septum that divides the anterior lamella from the orbital cavity. The canthal ligament is anchored to the periosteum on the edge of the orbital rim and is the primary structure addressed in static canthopexy (Figure 2). The third component is the superficial anterior lamella (Figure 3), comprising the orbicularis oculi. The upper and lower portions of the orbicularis merge at the level of the lateral canthus to form the raphe. In dynamic canthopexy, all 3 components are treated. A lasting, stable effect can be obtained only by lifting the deep structures (Figure 4).

The purpose of this study was to evaluate the results of dynamic canthopexy procedures performed in 30 patients over 10 years. Our aim herein was to establish the correct indications, verify the short- and long-term efficacy, and record all associated complications of this

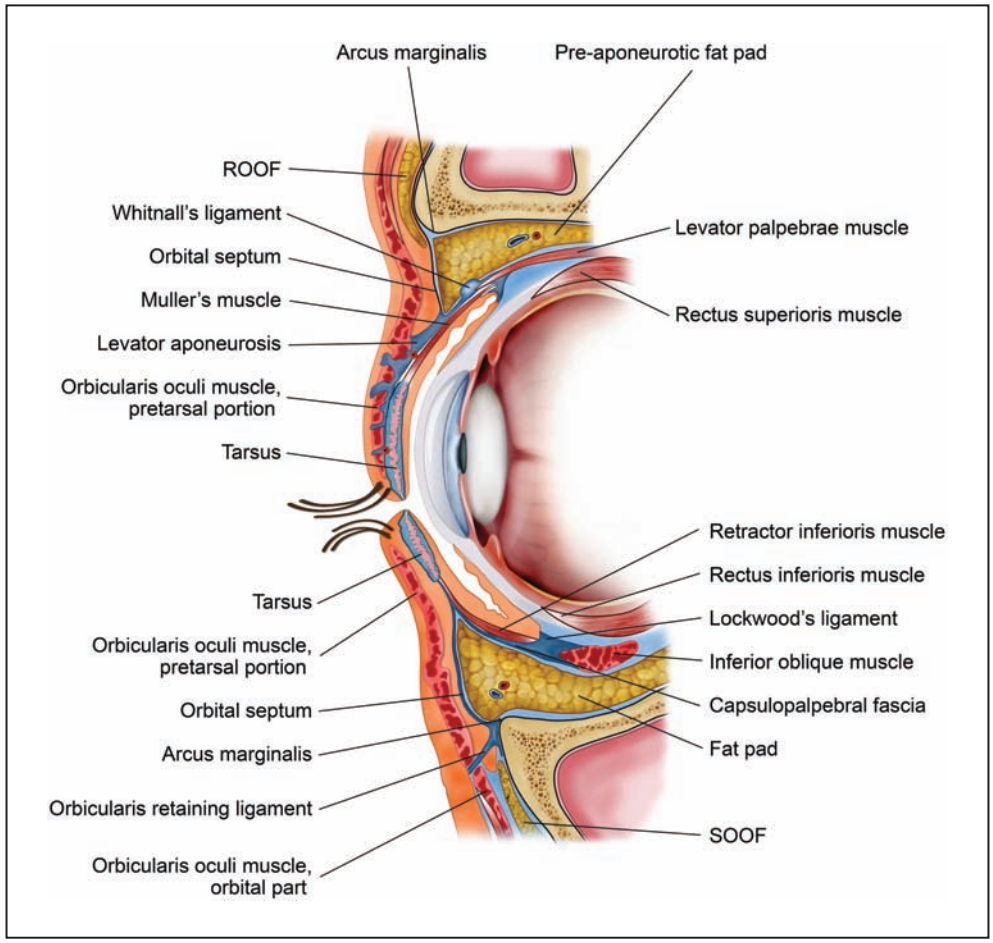

Figure 2. Sagittal section of the orbit depicting the relationships among the various components of the 3 lamellae. The orbicularis retaining ligament, which is situated below the lower eyelid and connects the muscle to the periosteum, often must be released to enable sufficient lift of the lateral canthus. ROOF, retroorbicularis oculus fat; SOOF, suborbicularis oculi fat.

procedure. The patient series included some individuals who presented with downslanting palpebral fissure and others with typical slanting of the palpebral fissure who desired elevation of the lateral canthus based on personal preference.

METHODS

Thirty patients who received dynamic canthopexy from January 2005 to March 2015 were evaluated in a retrospective case series. This study adhered to the principles set forth in the Declaration of Helsinki. All patients gave written, informed consent for inclusion in this study and for the surgical procedure. The study population entailed 18 patients (6 men, 12 women) who presented with an anti-Mongoloid palpebral slant and 12 patients (1 man, 11 women) who had a typical eye shape but desired an Asian eye appearance. All patients were examined carefully by a psychologist who ascertained how the appearance of the eye affected the patient's self-image. Patients who were considered by the psychologist to be unfit to undergo the procedure were excluded from the study. Also excluded from the study were patients with any eye pathology. Eye asymmetry, when present, was pointed out to patients before surgery, but this was not an exclusion criterion.

All included patients desired an upward shift of the canthal position. The surgeon obtained detailed photographic documentation of all patients at rest and under muscle contraction, with and without camera flash enabled. A careful physical examination also was conducted to verify that patients had no major anatomic concerns. Specifically, (1) lower-eyelid tone was found to be typical by standard methods, (2) the level of the lateral canthus was determined to be approximately 2 to 3 millimeters above that of the medial canthus, and (3) the lower eyelid was superimposed on the lower corneal limbus by approximately 1 to 2 mm. A few patients had lower scleral show without eyelid laxity; this was due to prominent eyes or was a nonpathologic anatomic variant.

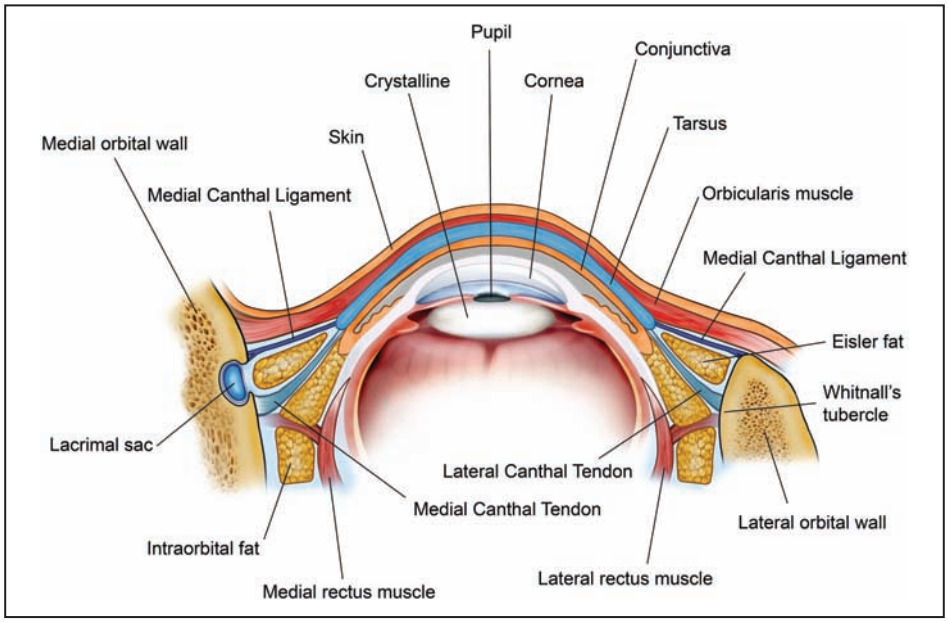

Figure 3. Transverse section of the orbit depicting the 2 main components of the lateral canthus suspension system; these components originate from the lateral extremity of the tarsus. The canthal ligament is more superficial and attaches to the orbital rim periosteum. The canthal tendon is approximately 5 to 6 mm deeper and reaches Whitnall's tubercule on the interior surface of the orbit.

Video 1. Watch now at https://academic.oup.com/asj/article-lookup/doi/10.1093/asj/sjz077

Patients also were assessed for relative globe prominence associated with deficiencies of the periorbital soft tissue or bone or resulting from true proptosis. The surgeon must exercise extreme care when performing canthal suspension in cases of globe prominence to avoid the so-called bowstringing effect. Prominent eyes can be treated by placing the fixating suture slightly superiorly (ie, anchoring it externally to the orbital rim) to avoid further caudal displacement, or pseudo retraction, of the lower-lid margin. This was not relevant to our case series.

Patients were advised to expect discomfort and eyelid distortion in the early postoperative period. The surgeon also explained that the position of the eyelids would be higher immediately after surgery but would shift slightly downward during the subsequent 2 to 3 months. For this reason, the lateral canthus was repositioned slightly superior to the desired level. Although placement of nonabsorbable sutures promotes fixation to stable structures (the tarsus on 1 side and the bone on the other), overcorrection is necessary to obtain reliable repositioning of the lateral canthus. The amount of overcorrection needed depends on individual anatomy and patient expectations; however, we suggest as a general rule that the canthus should be anchored 6 mm above the original insertion to achieve a lift of 4 mm.

Surgical Procedures

On both sides of the face, 4 to 5 mL of 1% lidocaine plus epinephrine (diluted 1:100,000) was injected, and 10 minutes elapsed to allow for maximal vasoconstriction of the soft tissues. Initial incisions (10 mm) then were made at the most lateral part of the upper eyelid (Figure 5), the lower eyelid, or both (Figure 6), and the raphe of the orbicularis was released from the periosteum. When initial incisions were made in the upper and lower eyelids, a tunnel was prepared between them.

Next, the canthal ligament and tendon—and, in many patients, the entire lateral septum and the orbicularis

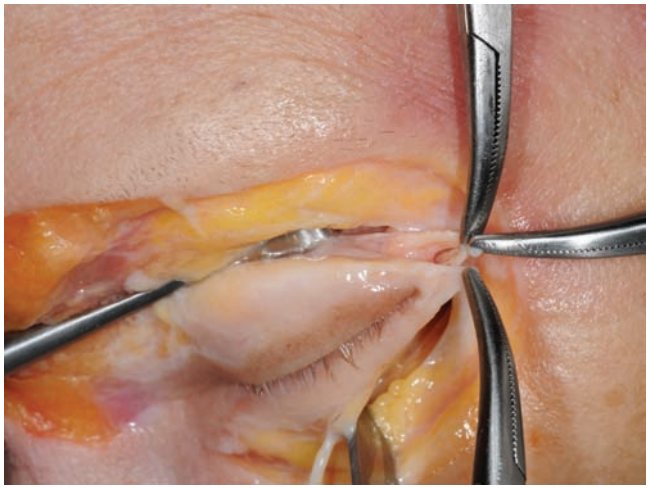

Figure 4. This 64-year-old male cadaver dissection showing the canthal ligament (the most lateral, thick part of the septum) and the 2 canthal tendons (merging laterally into 1 common tendon) held with clamps. To lift the canthus more than 2 mm, it is important to release both the ligament and the tendon and then reattach the entire lid suspension system to the bone at a higher level.

Figure 5. Upper lid access is depicted in this 35-year-old female who received dynamic canthopexy. At the most lateral part of the upper lid groove, a strip of skin is removed, and the orbicularis is divided to expose the orbital rim.

Figure 6. Upper and lower lid access to the lateral-canthal suspension system is depicted intraoperatively in this 35-year-old female who underwent dynamic canthopexy.

Figure 7. Dissection and release of the entire canthal suspension system, including the ligament, tendon, lateral septum, and orbicularis retaining ligament, is shown in this 35-year-old woman who also is depicted in Figure 5. These procedures yield complete mobilization of the commissure. A clamp holds the tendon-ligament complex, and the lateral orbital rim is clearly visible.

retaining ligament—were dissected and released to enable complete mobilization of the commissure (Figure 7). The periosteum of the superolateral orbital margin then was incised and undermined along its inner and outer surfaces, and 2 holes (diameter, 1 mm; spacing, approximately 3 mm) were drilled into the orbital rim bone (Figure 8).

A 5-0 nylon or polypropylene suture (Prolene, Ethicon, Somerville, NJ) was passed through the lower of the 2 holes from outside to inside (Figure 9). The tendon (Figure 10) or, for stronger fixation, the lateral extremity of the tarsus then was grasped, and the suture was passed through the upper orbital rim hole from inside to outside (Figure 11).

Figure 8. Drilling holes in the superolateral orbital rim. This patient also is depicted in Figures 5 and 7. Two 1-mm holes interspaced by approximately 3 mm are made in the orbital rim bone at the appropriate level. At this step, symmetry must be assessed carefully.

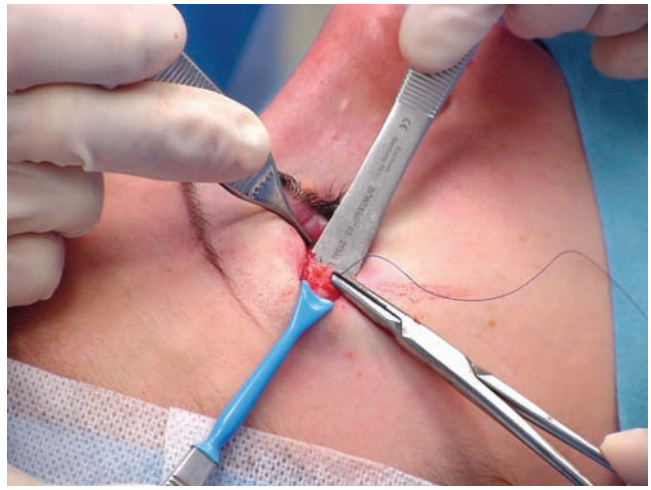

Figure 9. Starting the suspension suture. The needle of a 5-0 nylon or polypropylene suture is passed from outside to inside the orbital rim through the lower hole. This patient also is shown in Figures 5, 7, and 8.

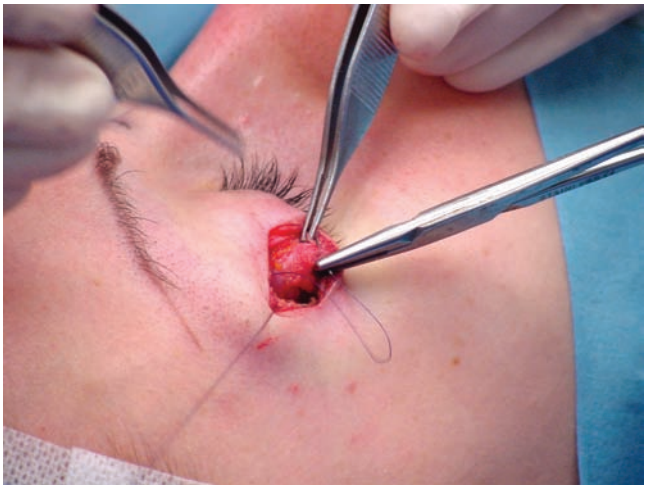

Figure 10. Anchoring the canthal tendon-ligament complex. The needle should be caught with a good bite of the previously released thick tissues to promote stable repositioning of the canthus. This patient also is presented in Figures 5 and 7-9.

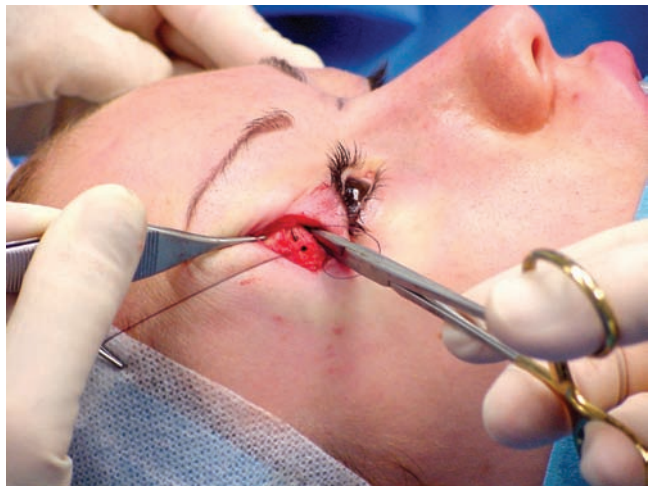

Figure 11. Fixation of the suture. The needle passes through the upper hole from inside to outside, and then the suture is fastened. It is not always necessary to tighten this suspender suture all the way to the knot. This patient also is depicted in Figures 5 and 7-10.

The tarsus is a rigid structure, and its fixation to bone allows for a lasting canthal lift. However, based on our experience, this anchor point is more likely to yield chemosis and conjunctival irritation because the solid, inelastic tissues can compress the lymphatic vessels. Because it is not possible to stretch the tarsus to place it in direct contact with the bone, a "suspender" suture must be placed.

Completion of these surgical procedures involves a "superficial canthopexy." Specifically, an orbicularis flap, taken from the lower eyelid, was fixed to the drill holes, the periosteum, or both on the external side of the superolateral orbital rim with a 4-0 polyglactin 910 suture (Vicryl, Ethicon). In our experience, firm anchorage of the orbicularis can help stabilize the effect of deep canthopexy in the early postoperative period.

For satisfactory results of dynamic canthopexy, fixed reference points must be utilized. We mark the original position of the canthus to help estimate the overcorrection needed to achieve the desired lift. A reference stitch can be positioned precisely at the level of the original ligament insertion. Well-defined anatomic structures, such as the lateral projection of the medial canthus or of the

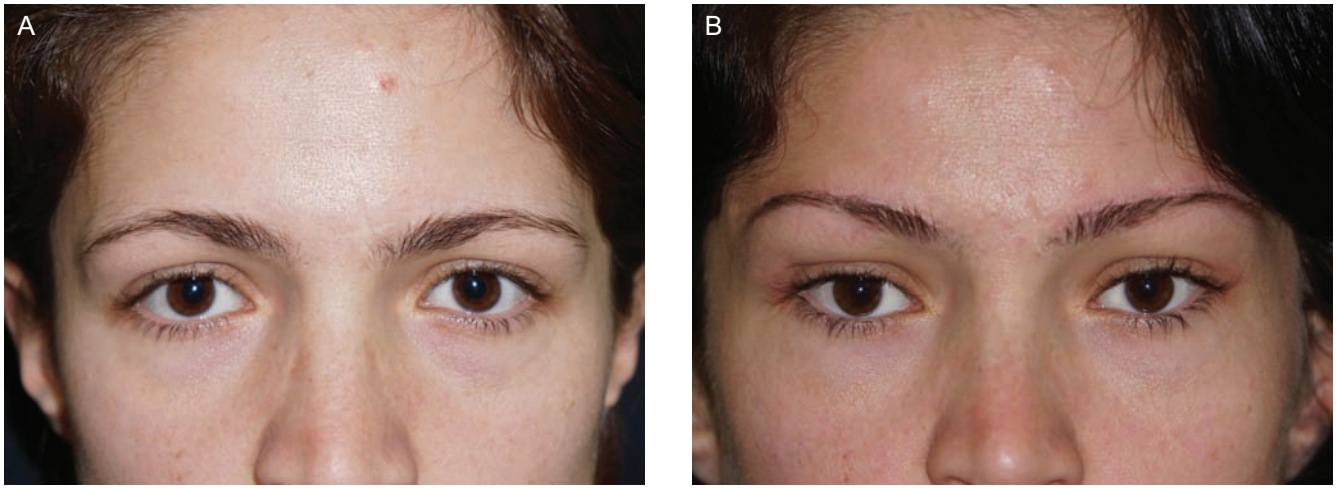

Figure 12. (A) This 34-year-old female presented with a moderate downslanting palpebral fissure and congenital scleral show. She underwent dynamic canthopexy and a direct browlift. (B) Twelve months postoperatively.

nasofrontal angle, also can be marked as reference points. We employ the lower limbus to assess symmetry, except in cases of orbital dystopia. At the end of a static canthopexy procedure, we aim to superimpose the lower eyelid edge on the lower limbus by approximately 2 to 3 mm. In dynamic canthopexy, we lift the lateral canthi to situate the lower eyelid at a slightly more superior position than in static canthopexy. A video demonstrating the procedure can be found online at www.aestheticsurgeryjournal.com.

Robust plication of the lateral canthal ligament usually is sufficient to lift the lateral canthus by approximately 1 mm. When a greater amount of lift is needed (ie, approximately 2 mm), we recommend detaching the ligament from the periosteum of the orbital rim and re-anchoring it at a higher position. When the lateral canthus is to be shifted 2 to 5 mm superiorly, the entire suspension system must be addressed. Specifically, we advocate releasing the tendons from Whitnall's tubercle and detaching the orbicularis retaining ligament from the infraorbital margin. If these steps are inadequate to mobilize or stably reposition the eyelid margin, the surgeon should consider releasing the septum or the retractor muscles from the tarsus through an infratarsal incision, either transconjunctivally or transcutaneously. Often it is sufficient to release the inferolateral portion of the septum along the insertion into the periosteum of the orbital rim (ie, the arcus marginalis).

Postoperative Care

After surgery, patients were given topical and oral antibiotics for 5 days postoperatively. To minimize eyelid swelling, patients received a single preoperative injection of 8 mg of betamethasone and were advised to apply ice packs (10-15 minutes per hour) during the first day after surgery. Patients were asked to score their satisfaction with the procedure on a scale of 1 to 10 (1, extremely dissatisfied; 10, extremely satisfied).

RESULTS

The 18 patients who presented with an anti-Mongoloid palpebral slant were aged a mean of 29 years (range, 18-38 years). The 12 patients with typical eye shape who desired an Asian eye appearance had a mean age of 31 years (range, 20-35 years). The mean operating time was 1 hour for both sides, and patients received postoperative follow-up at 6 months, 1 year, and every 2 years thereafter. The follow-up range was 4 years (mean, 12 months). All patients were able to resume typical social activity approximately 3 to 4 weeks postoperatively.

In our hands, this operation is highly effective. We are able to reposition the lateral canthus and create an upward palpebral slant that is reliable and durable. The final results of drill-hole canthopexy are evident at approximately 6 months post-surgically. All patients in this study had a perceptible lateral canthal lift. Twenty-five patients (83.3%) scored their satisfaction with the procedure as an 8 (scale, 1-10), suggesting that most patients were happy with the results of drill-hole canthopexy. However, dynamic canthopexy yields a radical aesthetic change that may affect a patient's psychological stability. In the current study, all patients received thorough preoperative guidance about what to expect after surgery, but 1 patient (3.3%) was uncomfortable with her postoperative appearance and chose to undergo revisional surgery to remove the suspension sutures.

Common complications in dynamic canthopexy are similar to those associated with lower blepharoplasty:[9] ecchymosis (almost 100% experienced a mild ecchymosis),

Figure 13. (A) This 33-year-old female presented with a severe downslanting palpebral fissure and received dynamic canthopexy. (B) Five days post-surgically, the slant is overcorrected, as needed. (C) By 12 months postoperatively, the result is symmetric, stable, and aesthetically pleasing.

swelling, hematoma, and asymmetry. In addition, patients who receive dynamic canthopexy may have a temporary sensation of excessive tension in the treated area. In the present study, excessive lower-lid tension occurred in 4 patients (about15%) and was associated with impaired eye closure. This complication resolved spontaneously in all affected patients within 3 months. One patient (3.3%) experienced asymmetry due to early unilateral detachment of the suspending suture and required revisional surgery at 1 year.

Chemosis is another possible postoperative sequela in patients who undergo dynamic canthopexy. In this study, 3 of the 30 patients (10%) experienced chemosis, including those with downslanting palpebral fissure features preoperatively and those who desired enhanced upslanting of typically shaped eyes. In these patients, chemosis persisted for approximately 2 to 3 weeks after surgery and was accompanied by a burning sensation, increased mucus discharge, and transient, mild blurred vision. Lateral tarsorrhaphy can help prevent chemosis; this was performed in 3 patients with no significant differences in the results among our patient population.

Figures 12-15 depict representative clinical cases. A patient who received dynamic canthopexy and direct browlift in the same surgical session is presented in Figure 12. The browlift entailed removal of a strip of skin immediately above the brow to reposition the brow superiorly. For the patient depicted in Figure 13, note the initial overcorrection (Figure 13B), which gradually settled by approximately 2 months and appeared stable at the 12-month visit (Figure 13C). The woman shown in Figure 14 requested treatment to achieve almond-shaped eyes and was satisfied with the result. The woman depicted in Figure 15 had previously undergone 2 blepharoplasty procedures and presented with iatrogenic displacement of the lower-eyelid margin. Her intention was to obtain a “cat-eye”

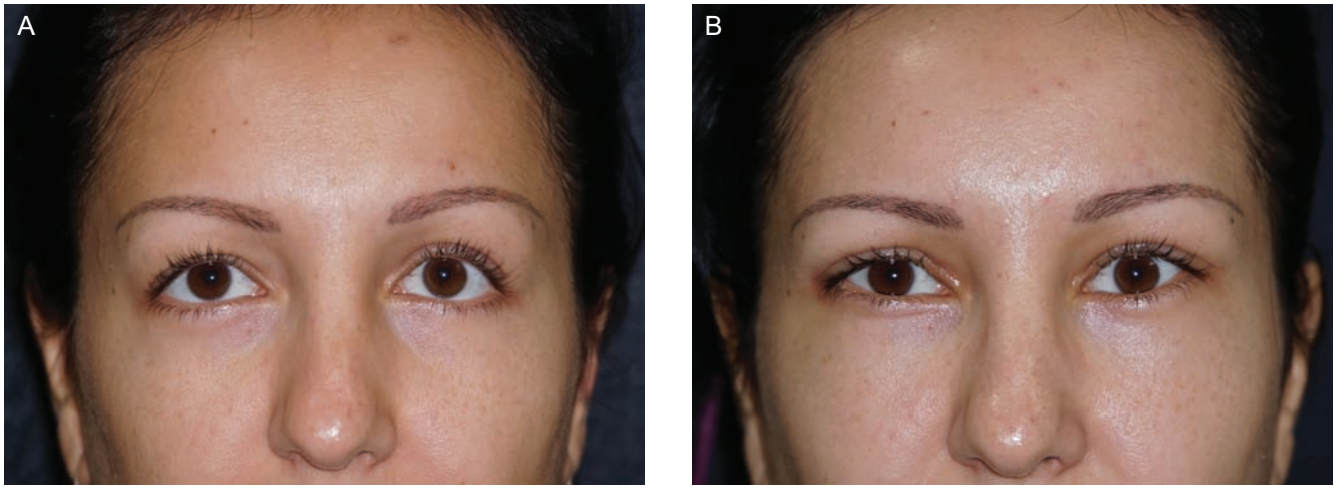

Figure 14. (A) This 33-year-old female requested upslanting eyes. Her lateral canthi were congenitally lower than the medial canthi. Dynamic canthopexy was performed, and (B) the effect is stable 12 months postoperatively.

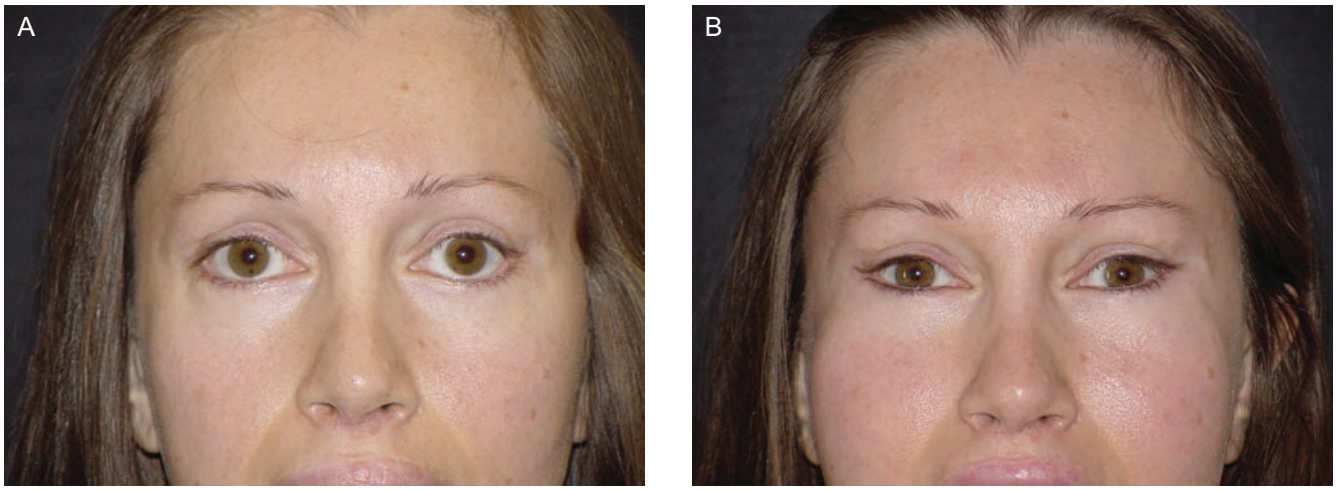

Figure 15. (A) This 38-year-old female underwent 2 lower-blepharoplasty procedures previously and presented to our clinic with moderate iatrogenic scleral show. She requested extremely slanted lateral canthi (ie, "cat eyes"). The patient had a psychological evaluation and was deemed fit to undergo the surgery. (B) Twelve months postoperatively, her aesthetic request is achieved.

appearance, characterized by a dramatic upward slant. We illustrate, with this case, that even unconventional aesthetic expectations can be met with our technique of drill-hole canthopexy. As mentioned previously, preoperative psychological evaluation is mandatory in such cases.

DISCUSSION

Dynamic canthopexy is a versatile procedure that can be applied to patients in whom the lateral canthus is situated lower than the medial canthus (ie, the downslanting palpebral fissure) and in those who request a more oblique eye appearance. The surgeon must have comprehensive knowledge of the ocular anatomy before undertaking drill-hole canthopexy. The practitioner also must explain to patients that this operation produces a major change in the shape of the eyes and can have profound aesthetic and psychological impacts.[20-34]

The surgeon should avoid accommodating requests for extreme upslanting palpebral fissures unless the patient is carefully evaluated and deemed psychologically fit to undergo this procedure. We emphasize the importance of multiple thorough discussions preoperatively and close postoperative monitoring in patients who receive dynamic canthopexy.[35-41] Presentation for this type of surgery is linked

with body dysmorphic disorder. In our clinical practice, candidate patients are shown postoperative photographs of other patients (at 4 days, 20 days, 3 months, and 1 year) to help them envision the outcomes of dynamic canthopexy—especially the overcorrection in the early postoperative period.

The surgeon should advise patients to expect to return to normal social activities approximately 2 weeks post-surgically if the canthus is lifted only slightly (ie, 1-2 mm). However, in canthal repositioning by 3 to 4 mm, the patient may not feel comfortable in social situations for 20 to 30 days. In addition to overcorrection, the patient likely will experience some edema, chemosis, and epiphora during that period.

This study is limited by its relatively small size, which followed from an infrequency in the general population of the downslanting palpebral fissure or of desires for an almond-shaped eye. A second limitation of this study is the subjective nature of the satisfaction survey. The anatomy of the lateral canthal system is highly delicate, and relatively small adjustments can produce major changes in the shape and appearance of the eyes. Our method of drill-hole canthopexy can accommodate a broad range of patient requests and yields reliable, durable results.

CONCLUSIONS

A pleasing overall eye aesthetic requires harmonious position and shape of the lateral canthal area. Our technique of dynamic canthopexy can be applied to treat cases of downslanting palpebral fissures or to accommodate patient preferences for a dramatic, upslanting eye. The results of this procedure are reliable and stable, and patients generally are satisfied with the postoperative outcome.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

Disclosures

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

Funding

The authors received no financial support for the research, authorship, and publication of this article.

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