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Comprehensive Periorbital Rejuvenation with Resorbable Endotine Implants for Trans-lid Brow and Midface Elevation

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The position of the eyebrows can significantly affect a person's appearance and perceived demeanor. Differences of a few millimeters can have a dramatic effect on periorbital aesthetics, and patients who seek upper blepharoplasty often have an element of brow ptosis that, even if mild, can limit the benefits of a blepharoplasty. Most interest in aesthetic brow surgery over the past 10 to 20 years has focused on major open or endoscopic procedures, and although the benefits of concurrent forehead and upper eyelid surgery are undeniable, many patients are reluctant to commit to an additional procedure, which compromises the final aesthetic appearance. Several limited incision procedures have been described for correction of mild brow ptosis but have never achieved widespread use, chiefly because of concerns about long-term fixation and stability of elevation. Similarly, lower lid blepharoplasty does not address all lower periorbital contour deformities. Simple orbital fat excision may remove some lower lid fullness but can accentuate suborbital hollowing from malar soft tissue atrophy and ptosis. Lower lid fat transposition can partially camouflage this

Video techniques for Transblepharoplasty Midface Lift with Endotine Fixation and Transblepharoplasty Browpexy with Endotine Fixation can be viewed online at http://www.theclinics.com/.

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appearance but does not address the central problem of the midface. Midface lifting has enjoyed a relative renaissance with the popularization of the extended endoscopic midface lift, but it requires an extensive forehead and temporal dissection. This article describes two periorbital techniques, easily combined with upper and lower lid blepharoplasty, that can strikingly enhance the periorbital appearance.

Transblepharoplasty browpexy with Endotine fixation

Modern aesthetic forehead surgery was first described by Hunt [1] in 1926, who advocated a coronal incision for forehead elevation. Subsequent early work on forehead surgery concentrated on excising and elevating the skin of the forehead and the brows. In 1976, Vinas and colleagues [2] published their approach, which consisted of a coronal incision, corrugator resection, and release at the supraorbital rims. Forehead lifting gained in popularity with the addition of forehead myoplasties, which improved results in treating transverse forehead and oblique glabellar lines. Issues with scar length, scar alopecia, forehead hypesthesia, and prolonged postoperative recovery limited patient acceptance, however, especially in cases of mild brow ptosis. Patients with mild (particularly lateral) brow ptosis often are unaware of their brow malposition and present for consultation requesting upper blepharoplasty only. This lateral upper lid "hooding" by ptotic infrabrow skin is not appropriately treated by blepharoplasty, and failure to address this condition concurrently can limit the benefit of an upper lid blepharoplasty (Fig. 1).

Alternative traditional approaches to the brow (midforehead or direct browlift) may not be appropriate or acceptable to a patient because of the visible scars. Several authors have advocated limited incision approaches to the brow to avoid visible incisions [3–6]. The procedures range from subfascial temporal approaches to subperiosteal transblepharoplasty approaches, and our understanding of brow dynamics has been significantly advanced by the work of Knize [7,8]. Each of these approaches requires incision, elevation/release, and fixation. Transtemporal procedures rely on fascia-to-fascia sutures and fibrosis, whereas transblepharoplasty approaches incorporate soft tissue to periosteum sutures, periosteal readherence to bone for fixation, and (often) myoplasties to reduce the downward displacement forces. Unfortunately, suture fixation to periosteum may fail because of the thin and wispy character of the forehead periosteum more than a few millimeters above the orbital rim, and the

Fig. 1. Preoperative views (*A, B*) show redundant upper lid skin prolapsing over eyelashes. After upper blepharoplasty, the improvement can be seen on oblique view (*C*). On frontal view (*D*), the effect is less dramatic because the patient refused an endoscopic browlift to treat the mild lateral brow ptosis.

elevation in these cases may be lost in the early postoperative period. Alternatively, the transtemporal and transeyelid approaches can be combined, and fixation can be established with lateral temporal fascia-to-fascia adherence and central periosteal sutures. The long-term permanence of the eyebrow elevation through these limited approaches continues to be a major concern, however.

Recently, a device designed to maintain brow elevation during the period of early readherence was introduced. The Endotine Transbleph Implant (Coapt Systems, Inc., Palo Alto, California) is a co-polymer of 82/18 L–lactide/glycolide and is designed to degrade by hydrolysis over a 6- to 12-month period. The device is two-sided. (1) The deep surface has a central post with a small flange designed to fit snugly into a 3-mm monocortical hole in the frontal bone. (2) The superficial surface has three 3- or 3.5-mm tines extending upward at roughly 45° from a thin platform that sits flush against the bone. The tines are designed to be impaled into the brow soft tissue and suspend the brow more superiorly. The low profile of the implant allows placement through an upper blepharoplasty incision.

Although the manufacturer advertises the use of the implant as a brow lift, it is more appropriately called a browpexy, because there is no soft tissue (including muscle) incision or modification, but rather subperiosteal elevation followed by semipermanent fixation of the brow at a higher position. Because there is no dissection over the temple, change of the position of the tail of the brow occurs to a lesser degree—and only passively. Because there are no modifications of periorbital muscles and dissection medial to the supraorbital neurovascular bundle is limited, significant change to medial brow position or glabellar contour should not be expected. This technique is best suited for subtly recontouring the arch of the lateral brow while secondarily elevating the brow 1 to 4 mm. The transblepharoplasty Endotine browpexy can be combined with other brow modifications for additional brow changes. In particular, this technique can be combined with myoplasties of the corrugator supercilii and procerus muscles for a more complete contouring of the brow when significant medial brow aging is present.

Indications and contraindications

The transblepharoplasty Endotine browpexy is indicated for recontouring the mildly ptotic brow. The use of the Transbleph implant is contraindicated in cases in which there is a suspicion that the skull bone may be thin. Relative contraindications for this technique are severe brow ptosis, moderate to severe glabellar furrows and medial brow ptosis (unless performed in conjunction with medial brow myoplasties), and prior orbital or forehead trauma. As with any periorbital surgery, patients should be assessed for dry eye syndrome before surgery to avoid unmasking or exacerbating a case of borderline xerophthalmia. Primary ptosis also should be ruled out, because brow suspension and fixation may limit a patient's pre-existing mechanism for compensation of the ptosis. This procedure can be performed in patients with prior blepharoplasty, although special attention is required during dissection to ensure the correct surgical plane.

Technique

As with any brow repositioning procedure, assessment of the degree of brow ptosis present at rest is essential. The patient is placed in a seated upright position, and marks with water-soluble ink are placed at the upper edge of the brows above the medial end of the brow, the midpupillary line, and the desired brow beak (either lateral limbus or lateral canthus). The brow is then manually raised to its ideal height by the surgeon and confirmed by having the patient evaluate the brow position in a mirror. It is important to insist that the patient focus on brow shape and position, not the upper eyelid crease contour at this stage. Once the desired brow position is confirmed, a pen point is placed over each of the suprabrow marks, manually holding the brow in its elevated position. Without moving the pen, the brow is released and allowed to fall to its natural resting position. Another ink mark is placed on the forehead skin directly under the pen point. This procedure is done for each mark, and the distances between each superior and inferior mark are measured to the nearest millimeter and recorded. Use of this technique in patents who desire medial brow elevation more than 2 to 3 mm or midpupillary line or lateral elevation more than 5 mm is not recommended, because results may be disappointing. The procedure is ideal for patients who require less than 2 mm of medial brow elevation and 3 to 4 mm of lateral elevation. Immediately before surgery, this process is repeated for confirmation, and with the brow held at its desired position, the required upper eyelid skin excision is planned and marked.

Anesthesia

This procedure can be performed with local anesthesia only or supplemented with intravenous sedation or general anesthesia. For analgesia and hemostasis, 1% xylocaine with 1:100,000 epinephrine is infiltrated into the upper eyelid skin and for bilateral supratrochlear and supraorbital nerve blockade. To ensure adequate block of the deep branch of the supraorbital nerve, a small amount of anesthesia is infiltrated along the superior orbital

rim lateral to the supraorbital notch. Small aliquots of anesthesia are also injected subperiosteally over the forehead, which typically provides excellent anesthesia over the forehead up to the crown. The dense attachments of fascia and periosteum at the "zone of fixation" around the temporal crests are difficult to completely anesthetize, however, and patients may experience some mild discomfort at these lateral limits of dissection (Fig. 2) [7].

Incision and elevation

A standard upper blepharoplasty supratarsal crease incision is used. It is advisable that initially surgeons defer upper lid skin excision until after brow repositioning, but once comfortable with the procedure, the upper lid elliptical skin excision can be performed immediately. The orbicularis oculi muscle is penetrated and the septum orbitale is identified. If preaponeurotic fat excision is needed, it is best deferred until the end of the procedure. The orbicularis muscle is then gently elevated with a cotton tip applicator off the septum until the superior orbital rim is exposed (Fig. 3). The supraorbital notch is palpated and the soft tissues over the orbital rim are incised with a cautery approximately 4 mm above the inferior aspect of the orbital rim, carefully staying lateral to the notch.

Fig. 2. Preoperative marks include the position of the supratrochlear nerves (*blue lines, asterisks*), supraorbital nerves (*blue lines,* +), temporal crests (*black dotted line*, ^), and planned areas of dissection (*red dotted lines*).

Fig. 3. The transblepharoplasty browpexy begins with an upper lid supratarsal crease incision followed by a preseptal, suborbicularis dissection to the orbital rim. Ptotic galeal fat is seen above the arcus marginalis.

Using a Freer elevator, the periosteum is elevated superiorly to the frontal hairline and laterally to the temporal crests (Fig. 4). Medially, dissection is limited by the supraorbital nerve. With the surgeon's nondominant thumb over the notch, the elevator is swept as medially as possible (see Movie 1). Once the dissection is performed bilaterally and the dissection pockets are connected, the forehead periosteum is elevated in between the temporal crests from the orbital rim to the hairline, except for a small triangle based along the orbital rim between the supraorbital notches.

Fixation

Fixation of the forehead flap is performed using the Coapt Endotine Transbleph implant. Except in patients with thin skin, the 3.5-mm tine implant is preferred. In a vertical plane above the desired brow peak, a monocortical hole is drilled into the calvarium with the supplied drill bit. Typically, this hole is

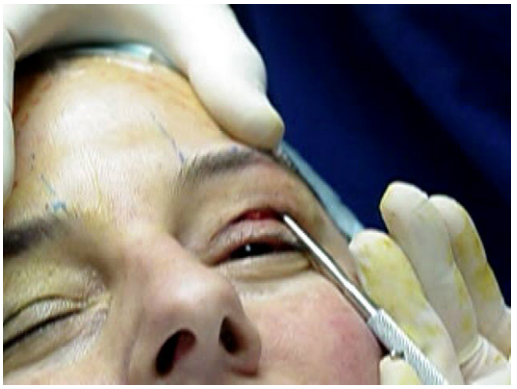

Fig. 4. The forehead is undermined subperiosteally through the upper lid incision after the periosteum is incised.

placed at a distance above the cut edge of the periosteum 2 mm more than the desired amount of elevation (Fig. 5). The transblepharoplasty bone post is then placed into the drill hole until engaged, and the introducer is detached. The forehead flap is then set on the tines. Under direct vision, the tines are impaled into the flap under the cut edge of the periosteum, which is suspended on the tines (Fig. 6). The brow position is then assessed; if the amount of elevation is not correct, the flap can be elevated off the tines and easily repositioned. The procedure chiefly elevates the lateral two thirds of the brow; however, the preseptal plane can be followed medially and the corrugator and procerus muscles divided if significant glabellar rhytides are present or a greater degree of medial brow elevation is desired.

Closure and dressing

If any upper lid skin resection is planned, it should be done at this point. It is essential to gently redrape the upper lid skin and avoid any bunching of skin in the infrabrow area. Although the planned upper lid skin resection was marked preoperatively, the surgeon must not overresect skin so as to avoid postoperative lagophthalmos. The wound is closed with a running subcuticular 6-0 Polene suture. A lightly compressive tape dressing is applied to the forehead for 24 hours, and the patient is told to apply cold compresses to the forehead and eyes for the following 24 hours. Patients are generally able to resume normal activities in 3 to 5 days (depending on ecchymosis). The forehead anesthesia and edema generally resolve in 1 to 2 weeks, although mild edema of the infrabrow skin may persist for several weeks.

Fig. 5. Once the elevation is complete, a 3.5-mm hole is drilled into the frontal bone approximately 2 mm above the desired brow peak.

Fig. 6. The Transbleph implant is positioned in the frontal bone, and the superior cut edge of the periosteum is suspended on the tines of the implant.

Transblepharoplasty midface lift with Endotine fixation

Currently, the most common approach to midface lifting is through an endoscopic temporal approach. This approach, however, may not allow for the optimal vector of elevation. Translid procedures have been described, but the risk of postoperative lid malposition has plagued these techniques [9]. This technique addresses this valid and major concern through the application of secure cheek flap fixation.

Indications

Two similar fixation devices are produced to elevate the midface. The Endotine Midface ST (soft tissue) and B (bone) devices are designed to elevate and fixate midfacial soft tissues via a transtemporal or translid approach, respectively. These devices elevate the ptotic midface differently and should be chosen based on patient needs. For patients with a significant medially angled ptosis, the Midface ST device is more appropriate; however, when the midface has descended in a primarily inferior vector, the Midface B device may be more useful, especially when there is significant infraorbital hollowing and tear trough deformity.

The translid midface lift can be performed through either a subciliary or transconjunctival approach. A canthal tightening procedure is recommended with both procedures, and canthotomy and cantholysis are generally necessary to adequately expose the superior maxilla for implant placement and fixation if the transconjunctival approach is used. Some skin excision is generally required in these procedures, although usually much less than might be expected. If significant skin excision is required, a pinch excision (with a transconjunctival

approach) or strip excision (with a subciliary approach) may be performed. Judicious skin resection is the rule.

Technique

The most critical aesthetic judgment is the determination of the appropriate vector of elevation. With the patient seated and the head and gaze in a neutral position, the surgeon identifies the bulk of the ptotic midfacial fat and subcutaneous tissue. This fat and tissue are then manually elevated (at first) superiorly and the effect noted. This elevation is shifted medially and then laterally, and the effects are noted. The direction that yields the most natural and aesthetically pleasing appearance is noted.

Anesthesia

Although this procedure can be performed under intravenous sedation or general anesthesia, with appropriate care it also can be performed with local anesthesia only. Bilateral infraorbital nerve blocks with 1% xylocaine with 1:100,000 epinephrine are performed first, followed by blockade of the zygomaticofacial nerves. After these injections begin to anesthetize the cheeks, the local anesthesia is infiltrated into the lower eyelids as for a lower blepharoplasty.

Incision, exposure, elevation, and release

If a subciliary incision is used, a skin-muscle flap is developed and a preseptal dissection is performed down to the orbital rim (Fig. 7). As with the upper eyelid in the transblepharoplasty browpexy, removal of pseudoherniated fat is deferred until after the midface procedure.

Once the infraorbital rim is exposed (with either approach), the periosteum is incised from medial to lateral, carefully preserving a cuff of periosteum along the entire anterior lip of the orbital rim. A subperiosteal plane is then developed over the entire maxilla, carefully isolating while protecting the infraorbital nerve (Fig. 8). Laterally, the dissection extends to the bony origins of the masseter muscle. Medially it extends to the ascending process of the maxilla and fibers of the levator labii superioris alaque nasi. Inferiorly it extends to the gingivobuccal sulcus (which is not incised) (see Movie 2). During the dissection, the zygomaticofacial nerve is often encountered near the junction of the malar eminence and inferolateral orbital rim. Care should be taken to preserve this nerve and avoid any stretching injury, because anesthesia or neuralgia over the superolateral cheek may occur postoperatively.

The periosteum inferiorly is then released by sharp incision and blunt inferior-to-superiorly directed stripping with a Freer elevator. This procedure should be done until the cheek flap can be elevated easily without any inferior tethering. The flap should be freely mobile from the nose (medially) to the masseter (laterally) and from the gingivobuccal sulcus (inferiorly) to the orbital rim (superiorly), except for the infraorbital neurovascular bundle. It is essential that the flap be easily advanced superiorly without any restriction or inferior traction on the lower eyelid.

Fixation

The Midface B implant is composed of a distal "rake," which has five 4.5-mm tines that can engage the periosteum and cheek soft tissue. The proximal portion is essentially a "leash" by which the implant can be advanced superiorly and fixed to the infraorbital rim. The primary vector of elevation (superolaterally, superiorly, or superomedially) can be tailored to the patient's needs by small

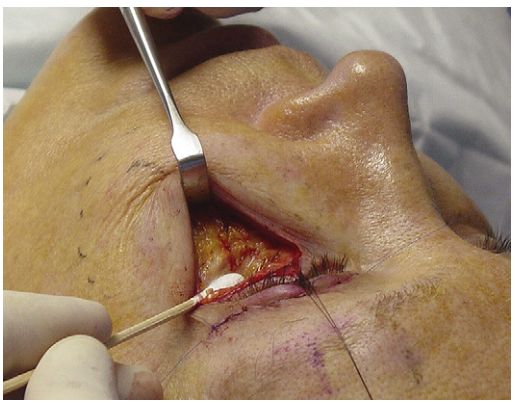

Fig. 7. The transblepharoplasty midface lift can be performed either through a subciliary incision (shown here) or a transconjunctival approach. The preseptal dissection is carried inferiorly to expose the infraorbital rim.

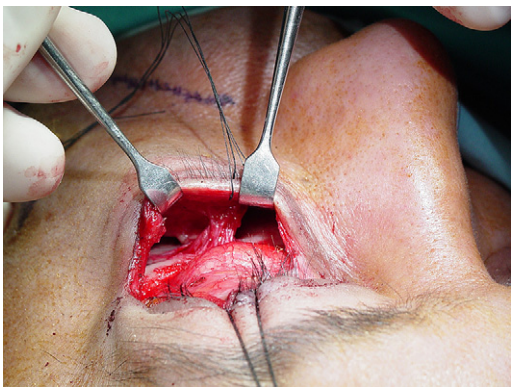

Fig. 8. After incising the periosteum on the anterior lip of the infraorbital rim, the midface is elevated in a subperiosteal plane.

adjustments in the sites of periosteal engagement and bony fixation. Once introduced, the position of the tines and vector of elevation are assessed for maximal benefit, and the periosteum is impaled on the tines (Figs. 9–11). A 3.5-mm hole is drilled and tapped in the lower portion of the infraorbital rim once the device has engaged periosteum inferiorly and the appropriate vector of elevation is chosen. A bioabsorbable screw is placed through the fixation device "leash" and into the bone hole. Once this screw is secured, additional sutures can be placed on low tension between the orbital rim and flap periosteum, which is particularly helpful in elevating soft tissue to correct tear trough deformities. Typically, one to three sutures are placed on either side of the Endotine bony fixation. Care must be taken to avoid any more tension on either the flap or orbital rim periosteum in placing sutures to gently drape the soft tissue over the rim.

Before the introduction of the Endotine Midface B device, I fixate the cheek flap to the periosteum along the infraorbital rim and a few millimeters lateral to the lateral canthus with 3-0 polydiaxanone or polygalactin 910 sutures. The periosteal cuff at the infraorbital rim is often flimsy and tolerates tension poorly, however, which makes reliance on this layer of tissue for secure fixation somewhat dubious. It can be difficult to place sutures to gently drape soft tissue into a tear trough. The addition of the Endotine Midface B implant allows transfer of the significant flap tension to the device and the orbital rim, which protects the lower eyelid from any significant inferior pull.

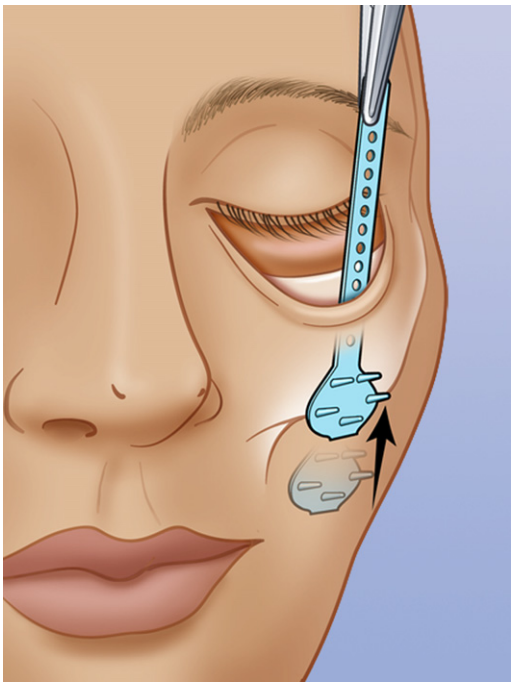

Fig. 10. The proper vector of elevation is determined by engaging the periosteum and malar fat with the implant tines and assessing for optimal improvement with different directions of pull. (*Courtesy of* Coapt Systems, Inc., Palo Alto, CA; with permission.)

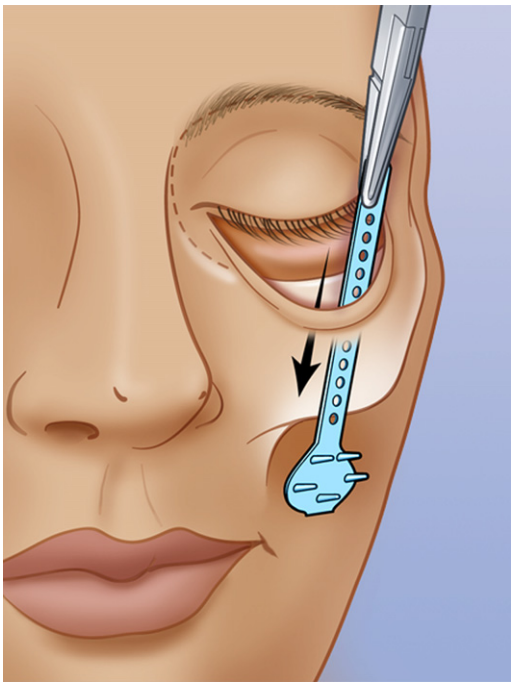

Fig. 9. Once the midface is elevated and released by incising the periosteum inferiorly, the Midface B implant is placed through the lid incision. (*Courtesy of* Coapt Systems, Inc., Palo Alto, CA; with permission.)

Lid support, skin resection, and closure

At this point, the orbital septum can be opened and pseudoherniated fat resected, if present. The lower eyelid support is re-established, most commonly with a lateral tarsal strip canthoplasty, although a lateral canthopexy may be substituted in the rare patient with excellent lower eyelid tone and support. If a transconjunctival approach with cantholysis and canthotomy is used, the canthal repair is performed and the conjunctival incision realigned and allowed to heal spontaneously. Redundant skin can be removed with a subciliary pinch technique at this time, theoretically avoiding disruption of the middle lamella of the lid. If a subciliary approach is used, the canthus is repaired or tightened and the appropriate amount of skin excision determined with the patient's gaze directed superiorly and the mouth opened. The skin is resected and the wound closed with interrupted 6-0 chromic sutures. With either approach, conservative skin excision is the rule. I inform patients that to avoid

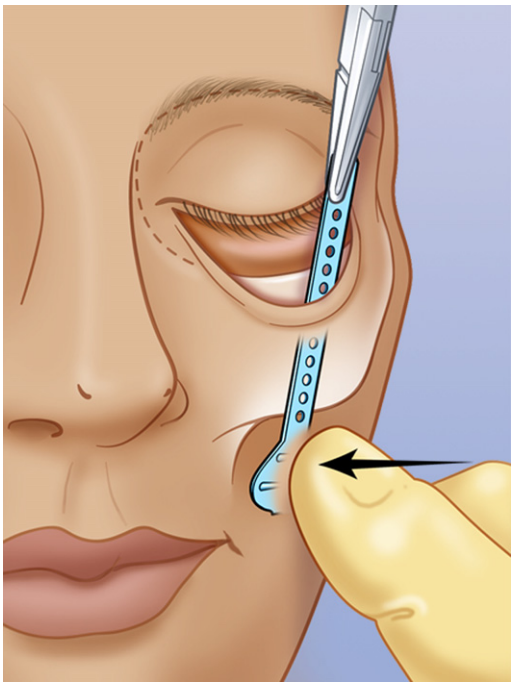

Fig. 11. Once the proper vector of pull is determined, the tines are further manually impaled on the implant tines. A monocortical hole is drilled on the infraorbital rim, and the Midface B implant is fixed at the drill hole with a biodegradable screw. (*Courtesy of* Coapt Systems, Inc., Palo Alto, CA; with permission.)

postoperative lid malposition from excessive skin resection, there may seem to be some minimal skin redundancy for the first few weeks. If this excess skin persists, it can be removed easily 3 to 4 weeks postoperatively under local anesthesia.

Results

Transblepharoplasty Endotine browpexy

The transblepharoplasty browpexy has been well received by patients and provides a simple and relatively quick method to treat mild central and lateral brow ptosis (Fig. 12). It is particularly useful in patients undergoing concurrent upper lid blepharoplasty who would benefit from a modest lateral brow elevation. Most patients note smoothing of forehead rhytides, similar to an endoscopic browlift, which persists even after resolution of postoperative edema.

Moderate postoperative edema is the rule, but as with endobrow procedures, forehead edema generally resolves in 2 to 3 days. Persistent infrabrow swelling is common and may last 4 to 6 weeks. Although this swelling is generally subtle, it may obscure some of the benefit of the lateral brow elevation and upper blepharoplasty, and it is important to counsel patients about this possibility preoperatively. Forehead hypesthesia typically lasts 2 to 4 weeks, and if the deep branch of the supraorbital nerve is affected, it may extend from the level of the brows to the vertex. Rarely, in my experience, postoperative neuralgia can occur and typically is related to the lateral dissection and presumed injury to the deep branch of the supraorbital nerve. Patients generally can palpate a mild fullness deep to the lateral brows as early as 3 weeks as swelling subsides, but the profile of the implant is generally not visible in all but patients with thin skin and brow soft tissue atrophy. The Transbleph Endotine implants are available with either 3- or 3.5-mm tines, and although most patients tolerate the longer tines well, patients with thin skin and brow soft tissue atrophy should be treated with the 3-mm tines and considered for injectable soft tissue augmentation.

Transblepharoplasty midface lift with Endotine fixation

Results with this technique have been excellent. Complications are uncommon if proper precautions and a conservative approach are taken. There is usually significant chemosis postoperatively, which generally resolves in 2 to 3 days. If it persists longer, topical steroid eye drops (if not contraindicated) can be used for 4 to 5 days to hasten resolution of the chemosis. Significant lid retraction should be treated aggressively, and early reoperation should be considered if fixation was deemed inadequate. Patients may note facial hypesthesia in the distribution of the infraorbital nerve for 2 to 3 weeks, but it sometimes can persist for a longer period of time. Patients should be followed for decreasing density and area of distribution of the hypesthesia until complete recovery can be documented. Patients occasionally may complain of pain over the malar eminence, probably caused by stretching of the zygomaticofacial nerve, which generally resolves in 3 to 4 weeks. Most patients notice some mild trismus for 3 to 7 days if a complete subperiosteal dissection up to the masseter muscle insertion was performed. No patient to date has complained about implant palpability. In general, patients have been pleased with the results of this procedure, typically returning to normal activities in 5 to 7 days and work in 7 to 14 days.

Summary

As with any new technology or device, the science of the material and the wound-healing processes involved should be considered when examining claims of longevity. The manufacturer claims that the material is fully resorbed by 12 months through a process of hydrolysis but loses significant strength

Fig. 12. Preoperative (*A, C*) and postoperative (*B, D*) views of a patient who underwent transblepharoplasty browpexy and transblepharoplasty midface lift under local anesthesia. Note the improved brow position and contour. In the midface, there is a shortened lower lid length, elimination of the double contour of the lower lid and cheek mound, and effacement of the tear trough. The shape of the face is less "square" postoperatively, with an increased bizygomatic width.

by 20 weeks. Because these implants are fully resorbed over time, the longevity of the results depends on the fixation of the elevated tissues to the deep structures that develops before the loss of device strength and integrity and any modification of inferiorly directed forces. Myoplasty is not intrinsic to either of these procedures, so it is reasonable to assume that longevity of elevation is caused by healing of the periosteum to bone at the new, elevated position, counterbalanced by differential ptosis of the more superficial tissues. Sclafani and colleagues [10] previously showed that the bone-periosteum bond is well established by 6 weeks in an animal model, whereas others have described faster time courses [11,12]. In light of this report, late loss of elevation presumably would be caused by resorption of tines that are engaging tissue above the periosteum (eg, retro-orbicularis oculi fat or galeal fat [brow], suborbicularis oculi fat or malar fat [midface]). During my 18 months of experience with the Transbleph device, I have not seen a late (>6 weeks) loss of elevation; my follow-up with the Midface B device is less (approximately 6 months), but again no late loss of elevation has been noted. Over the long-term, facial aging will continue with ptosis of supraperiosteal tissues, but it would seem unlikely that the benefit gained by these procedures would be lost.

The introduction of the Endotine Transbleph and Midface B implants has allowed a more accurate and secure elevation of brow and midfacial tissues, respectively, with only minor modifications of previously described techniques. These implants have been consistent is their ease of use, and results have been reproducible. These implants have allowed the expansion of existing techniques in a way that allows better and more specific treatment of patients who otherwise might not have achieved optimal results.

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