Direct Needle Fixation in Endoscopic Facial Rejuvenation

Carlos Casagrande, MD; Renato Saltz, MD; Roberto Chem, MD; Rinaldo Pinto, MD; and Marcus Collares, MD

Background: *Several authors have described the application of video endoscopy to facial rejuvenation to minimize incisions. Methods of fixation used in this technique include miniplates, tunnels in the outer tissues, and tissue glues.*
Objective: *In this study, we examined the efficacy of endoscopic facial rejuvenation with direct transcutaneous needle fixation.*
Methods: *Detailed preoperative markings were placed to outline important anatomical structures for the dissection. Dissection was performed through use of endoscopic visualization. Direct needle fixation was performed through a temporal incision.*
Results: *In a series of 50 patients, we found that subperiosteal lifting with direct needle fixation allows more precise repositioning of the inferior, periorbital, and frontal regions. In 30 patients undergoing additional treatment for the midface, this technique eliminated the need for midface intraoral and/or infracilliary incisions.*
Conclusions: *Endoscopic facial rejuvenation through use of direct needle fixation provides safe and aesthetically pleasing results with a high level of patient satisfaction at 24 months' postoperative follow-up.*

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Endoscopic lifting of the frontal region is a well-established technique with good results. Different methods of fixation and repositioning of the soft tissues have been described by many. In this article, we describe a technique in which direct fixation is obtained through a transcutaneous introduction of a needle. Surgical results observed in 50 patients who underwent subperiosteal endoscopic frontal lifting with direct needle fixation demonstrated that the direct needle fixation method allows greater freedom in the repositioning of the inferior, periorbital, and frontal regions. Each of 30 patients also underwent midface treatment with only a temporal incision. This treatment avoided intraoral or facial incisions for fixation of the soft tissues; it was thus less traumatic and easier to perform, with satisfactory long-term results.

Surgical Technique

Fifty patients with indications for facial rejuvenation were treated with endoscopic lifting. All underwent lifting of the extended frontal region. Sixty percent were also treated for the midface.

Figure 1. *Marking of lifting vectors where direct fixation sutures are placed.*

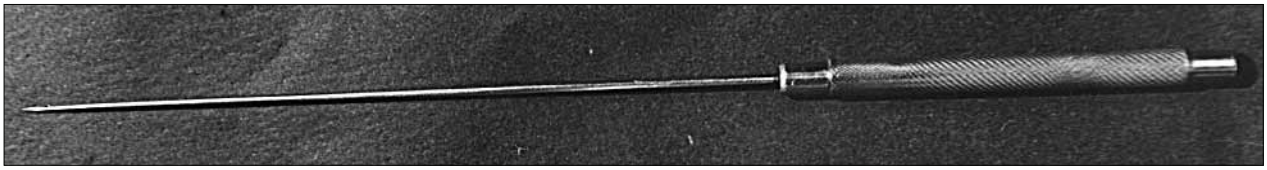

Figure 2. *Needle for fixation.*

The treatment started with a preoperative evaluation and planning, which included a clinical demonstration of the new eyebrow position. Detailed preoperative markings were placed to establish important anatomical structures for the dissection. The supratrochlear and supraorbital nerves were outlined laterally to the glabellar midline at 1.4 and 2.4 cm. The frontal branch of the facial nerve was outlined through an imaginary line from the tragus to 1.5 cm above, and laterally to the tail of the eyebrow. The sentinel vein is located at 1.5 cm laterally to the lateral canthus and 1.3 cm above it. The zygomatic arch, lateral orbit, and temporal crest are the bony margins of the dissection. The traction vectors for repositioning of the eyebrow were also outlined. For treatment of the midface, the inferior orbital rim and the position of the infraorbital nerve were outlined, as were the medial quarter of the masseter muscle and buccal sulcus. Points of fixation were determined in each hemiface. They are related to the locations of the malar fat pad and supraorbital fat.

Anesthesia included regional facial nerve blocks and sedation. General anesthesia was used for combined procedures. The marked areas were infiltrated with local anesthesia and epinephrine (Figure 1).

Dissection

The endoscopic entry points were limited to two temporal incisions placed 2 cm posterior to the hairline, two 1-cm paramedian incisions located at the level of the hairline and at the pupillary axis, and a midline vertical incision. The dissection was performed laterally above the deep temporal fascia through the temporal incisions. The zygomatic arch is the inferior limit of dissection. Medially, the dissection continued along the superior and lateral orbital rim in a subperiosteal plane, with complete release of the attachments of the periosteum fusion line to the orbital rim. At the conclusion of the temporal release, the frontal region was dissected in a subperiosteal plane. Both areas were connected through complete release of the temporal crest fascial fusion zone. This part of the procedure was safely done by endoscopic visualization. At this point, the periosteum was completely separated from the superior and medial orbital rims with complete release of the brow. The glabellar musculature (procerus, corrugators, and depressor of supercili) was carefully dissected and, if necessary, myomectomies were performed (Figure 2).

When the midface was treated, the dissection continued caudally in the temporal region, with coagulation of the

Figure 3. *Method of direct needle fixation for midface lifting.*

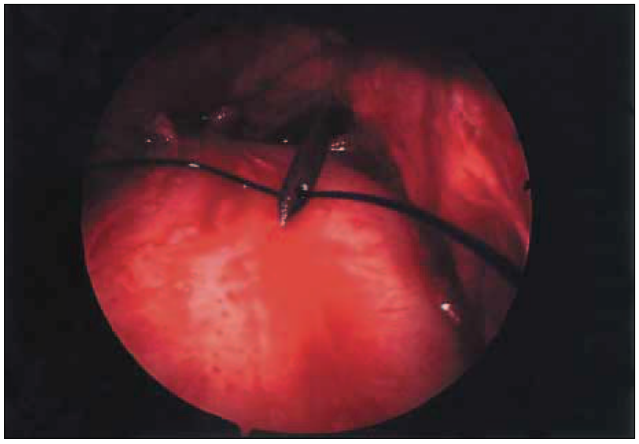

Figure 4. *Endoscopic visualization of suture thread through the needle.*

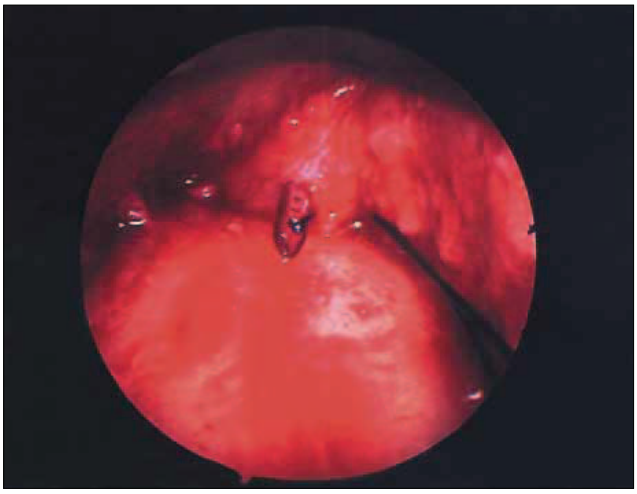

Figure 5. *Needle passing suture through soft tissue and not exteriorized through skin.*

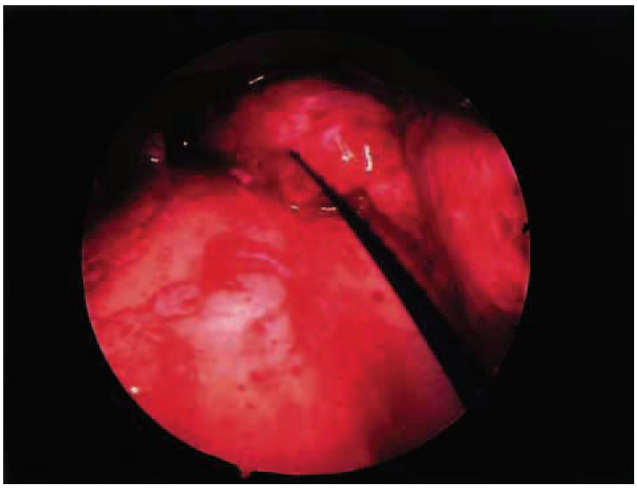

Figure 6. *Endoscopic visualization of traction and midface soft tissue elevation.*

sentinel veins. The undermining continued in a subperiosteal plane into the malar region. Initially, the suborbicularis oculi fat (SOOF) and the lateral orbital rim could be visualized. With more medial dissection and undermining, the infraorbital nerve was also visualized. If only extended frontal lifting was performed, the dissection is stopped at this point. For treatment of the midface, the dissection continued by releasing the insertion of the masseter muscle on the malar bone. The inferior border of the dissection was the superior gingival sulcus, where release of the periosteum was performed.

Fixation

Fixation began after the undermining was complete. Our preferred method involves fixation both in the frontal region and in the middle third of the face with direct needle fixation. For this procedure, a straight, thin needle with an eye was developed, based on the principles of the Reverdan needle (Figure 2). The needle was introduced through the skin at points preoperatively demarcated for skin elevation. After the needle was introduced through the skin, endoscopic visualization allowed direct observation of needle penetration in the optical cavity. The needle was then carefully drawn out through the temporal incision, and the suture was introduced through the eye of the needle. The needle was passed back under the skin and, after a small trajectory through the soft tissues, was brought out again externally through the temporal incision and secured to the deep temporal fascia. At this point,

the suture material was removed from the needle's eye and kept attached to the soft tissues for fixation and elevation (Figures 3-6).

Preoperative outlining of the nerves in this region helps the surgeon to avoid any damage during this needle maneuver. The soft tissues of the midface were fixated first. In extended frontal endoscopic lifting, there was only 1 fixation point at the level of the SOOF. For endoscopic midface lifting, we used 2 points of fixation, the first located at the level of the malar fat pad and the second to the SOOF. In the frontal region, the fixation points were applied where necessary for brow elevation. Usually, the first fixation point was applied in the direction of the lateral canthus, the second at the level of the lateral brow, and the third at the hairline. Once all of them were positioned, the sutures were secured to the level of the deep temporal fascia. The order of fixation is inverse to that of the dissection, starting with the middle third and followed by the superior third. Vicryl 3-0 is the suture of choice. When fixation of the midbrow is necessary, 14-mm screws are placed at the level of the outer table and remain percutaneous. In periorbital rejuvenation, CO_2 laser resurfacing can be combined with this procedure.

Results

All patients underwent endoscopic frontal lifting. Sixty percent also underwent endoscopic lifting of the midface. Edema lasting longer than 1 month was observed in 5% of cases and occurred at the level of the midface. Recovery was excellent in all cases once massage was instituted. Fixation was accomplished through use of the direct needle method. Skin depression at the level of the needle entrance was observed in 2 cases; they were corrected by undermining of the incision area and, if necessary, injection of fillers. Two cases had early recurrence of ptosis of the soft tissues of the middle third of the face. This was probably caused by an insufficient dissection of the masseter muscle insertions to the malar region. Fixation of the middle brow with 14-mm screws was performed in 40% of cases in addition to needle fixation. The screws were removed 10 days postoperatively. Temporary upper lid paresthesia occurred in 1 patient and resolved completely in 30 days. Temporary frontal region paresthesias were observed in 4% of patients and also resolved completely within 3 weeks. Upper lid blepharoplasty was performed in 20% of patients. The amount of the skin resection was minimal, with a scar that was significantly shorter than in conventional cases.

Forty-eight percent of the patients underwent CO_2 laser skin resurfacing in association with the endoscopic procedure. Inferior eyelid resurfacing was performed in 90% of these cases, even in Fitzpatrick-type 4 skin. Combined cervical facial lifting was performed in 42% of cases (Figures 7 and 8).

Discussion

Many patients seen in consultation for facial rejuvenation or blepharoplasty present with forehead and eyebrow ptosis relevant to their overall aesthetic appearance. It is up to the plastic surgeon to make the correct diagnosis and clearly point this out to the patient. To understand these aging changes, it is critical to understand the pathophysiology and anatomy of the forehead region.[1]

Relevant aesthetic parameters include the level and shape of the eyebrows, the forehead, and the periorbital regions. Farkas,[2] McKinney,[3] and Daniel[4] demonstrated that in young patients, the average distance from the midpupil to the superior border of the eyebrow is 2.5 cm in length and varies from 2.3 to 2.9 cm. The superior border of the eyebrow to the hairline measures approximately 4.8 cm and varies from 4.0 to 7.0 cm. There are 3 types of eyebrows: *straight* (60%); *curved* (20%), where the central portion is higher in relation to the inner and outer border; and *arch* (20%), where the lateral border is slightly higher. In the study by Daniel,[4] the arch and the slightly curved brow shape were defined as the most attractive. It appears that a slightly elevated lateral third of the brow is one of the aesthetic criteria of beauty.[5]

The muscles of the frontal orbital region are extremely important in the position and treatment of the eyebrow. The frontalis muscle laterally ends abruptly at the level of the fusion line along the temporal crest. It is an extension of the galea cranially that lies at the level of the base of the hair follicles and continues to the supraorbital dermis. Its function is to elevate the brow. The entire lateral segment of the eyebrow that is not sustained by the frontalis muscle will have a more prominent descent.[6] Consequently, the ptosis of the tail of the eyebrow is usually more significant. The muscles of the medial region—the procerus, corrugators, and orbital portion of the orbicularis oculi—pull the eyebrow medially and inferiorly. They have an important role in the ptosis of the medial brow.

Many times, when a patient presents with an excess of palpebral skin, the excess is really the result of severe brow ptosis caused by anatomical changes and gravity.[1]

Figure 7. *A 50-year-old woman who underwent frontal and midface lifting with direct needle fixation and cervical lifting with retroauricular incisions only.* **A, C, E,** *Preoperative views.* **B, D, F,** *Postoperative views 24 months after surgery.*

Figure 8. *A 65-year-old woman who underwent frontal and midface lifting with direct needle fixation and full-face laser resurfacing.* **A, C, E,** *Preoperative views.* **B, D, F,** *Postoperative views 12 months after surgery.*

Frequently, ptosis of the frontal region and eyebrows is the most significant component of the excess skin.

Aging affects all of the facial structures, soft tissues, and bone. The descent of the soft tissues accentuates the nasal labial sulcus, creates depressions in the periorbital region, and entraps the periorbital fat, causing the development of lower eyelid bags.

The first study applying video endoscopy to facial rejuvenation was done in 1992 at the University of Alabama.[7] Since the publication of that study, several authors[8-11] have described the application of different video endoscopic techniques to frontal face lifting. The advantages of video endoscopy are minimal incisions, minimal bleeding, and the magnification of images, which allows excellent visualization of the anatomy and provides more precise repositioning of the soft tissues. Avoidance of skin resection and repositioning with fixation of the anatomical structures eliminate tension at the level of the scar, with minimal scar widening or alopecia. Other advantages of this technique include the possibility of performing myotomies in the depressor musculature, freeing the eyebrow from its deep attachments and thus allowing complete repositioning and access to the midface. Through this approach, the surgeon can treat the nasal labial sulcus, restore the malar prominence, and correct periorbital depressions (tear trough) and inferior eyelid fat pockets through a temporal incision.

An important component of this technique is the significant shortening of the periauricular scars and, in many cases, the complete treatment of the face through use of small hairline and retroauricular incisions for the cervical region. Many methods of fixation have been described in the literature, including miniplates, tunnels in the outer table, and tissue glues.[8-10] In the traditional endoscopic subperiosteal brow lift technique, the temporal region is fixated with monofilament. The galea of the temporal flap is brought to the deep temporal fascia to the level of the temporal incision. Because of technical difficulties in accomplishing this important step in the elevation of the temporal region, we propose the application of direct transcutaneous fixation. The advantage of this technique is that the surgeon can set up the vectors of elevation exactly as planned for the elevation of both the frontal region and the midface without any additional morbidity.

Conclusion

The direct visualization and fixation of the anatomical structures involved in facial aging, combined with safe dissection and minimal complications, have made endoscopic surgery the technique of choice in the treatment of the aging face. Endoscopy allows the surgeon to obtain direct visualization and safe dissection in a subperiostial plane, achieving adequate and long-term suspension by using direct needle fixation through a temporal incision. This permits precise positioning of the area to be elevated through direct fixation with sutures, resulting in a more predictable outcome. Subperiosteal dissection provides adequate blood supply to the flaps and allows the simultaneous use of skin resurfacing techniques, such as lasers and chemical peels.[12] ■

Acknowledgment

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Endoscopic Brow Lift: Incision Placement

To the Editor:

Dr. Vasconez and colleagues have contributed immensely to the development of endoscopic plastic surgery techniques and instrumentation. Their recommendations in the January/February issue of *Aesthetic Surgery Journal* (2002;22:69-71) for improvement in incision placement and fixation and avoidance of complications are welcome.

In 8 years of performing endoscopic brow lifts, I have found that incisions behind the hairline continue to provide less conspicuous scars than the prehairline placement recommended. Any trauma to the surrounding skin during endoscopic instrumentation is minimized by direct excision at the time of surgery. Alopecia has not been a problem since staples were discontinued in my practice. Like the authors, I found rigid fixation to be necessary in all cases. However, I alternate between permanent absorbable and percutaneous screws.

Fibrin glue (Haemacure Corp, Montreal, Quebec, Canada) has eliminated the use of drains by providing early adherence of the periosteum to the bone, as well as hemostasis. ■

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Thirteen Years of Experience With the Endoscopic Midface Lift

Renato Saltz, MD; and Bianca Ohana, MD

Abstract

Background: Numerous techniques have been used to rejuvenate the aging midface. The Endotine midface technique involves an endoscopic temporal approach, including midface dissection and malar suspension with fixation. The Endotine device (Microaire, Charlottesville, Virginia) eliminates the intraoral incision and use of sutures, enabling multipoint fixation and fast, simple adjustability for optimal control of midface elevation and volume.
Objectives: The authors describe their preferred technique for the endoscopic midface lift and summarize their 13 years of experience.
Methods: A retrospective chart review was conducted of 183 patients who underwent endoscopic midface surgery. Patients treated from 1998 to 2003 received direct needle fixation (n = 95). Those treated later underwent fixation with the Endotine device (n = 88).
Results: Most (90%) of the patient population was female, and the average age at the time of surgery was 46 years (range, 39-54 years). Needle fixation was used in 95 patients and Endotine fixation in 88. The average follow-up period was 7 years. The authors have observed many improvements in outcomes since the introduction of the Endotine device into their practice. These include reduced swelling and bruising, more symmetric elevation of the malar fat pad, mild improvement of tear trough deformity, softening of the nasolabial folds, and, in some cases, decreased "jowling." The asymmetry often associated with direct needle fixation has decreased, and no skin dimpling has occurred. Through their experience, the authors' preferred technique has become the temporal-only approach with Endotine fixation.
Conclusions: The Endotine midface suspension device enhances soft-tissue fixation, provides simple adjustability for optimal elevation and projection, and maintains mechanical fixation until biologic fixation becomes adequate. The 5 tines provide multiple points of contact for secure soft-tissue fixation. Elevation forces are evenly distributed over a wide area, which eliminates skin irregularities. Insertion and deployment are accomplished easily through temporal incision.

Level of Evidence: 4

Keywords

facial surgery, facelift, midface, endoscopic, Endotine, aging process, malar fat pad

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Techniques for aesthetic rejuvenation of the face, which have continued to improve with time and experience, are a major focus of plastic surgeons, patients, and the media. In recent years, many surgical techniques have been introduced, along with modifications to existing procedures. Modern trends emphasize long-lasting results with smaller scars.

Successful midface rejuvenation depends on understanding patient concerns, establishing an accurate diagnosis, and executing a safe and appropriate treatment plan.[1] To achieve optimal results, it is essential to have a thorough understanding of the anatomy and pathophysiology of midface aging. Many authors, including Hester et al,[2] Paul,[3] Ramirez,[4] Hamra,[5] and Mendelson et al,[6] have clearly defined the anatomic structures and findings common to midface aging and have described various treatment options. In a 2008 publication, Downs and Wang[1] highlighted some of these authors' findings. For instance, Hester et al[7] described the elements of midfacial aging as gradual ptosis of the cheek skin below the infraorbital rim (creating a skeletonized appearance with infraorbital hollowness), descent of the malar fat pad with loss of malar prominence, deepening of the tear trough, and exaggeration of the nasolabial fold.[1] Hamra,[5] upon reviewing his own work, believed that the only way to correct nasolabial

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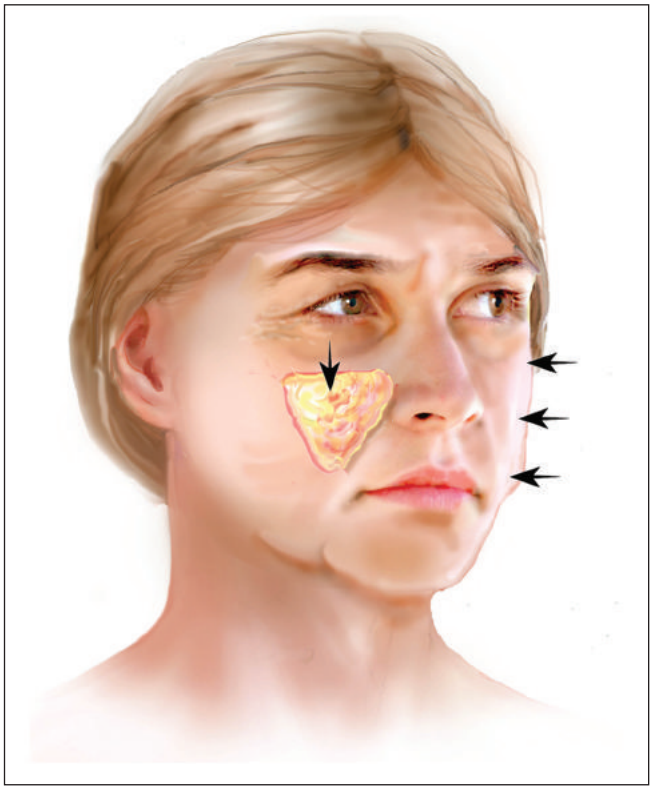

Figure 1. Midface aging process at the beginning: descent and deflation of the malar fat pad. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery*. 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

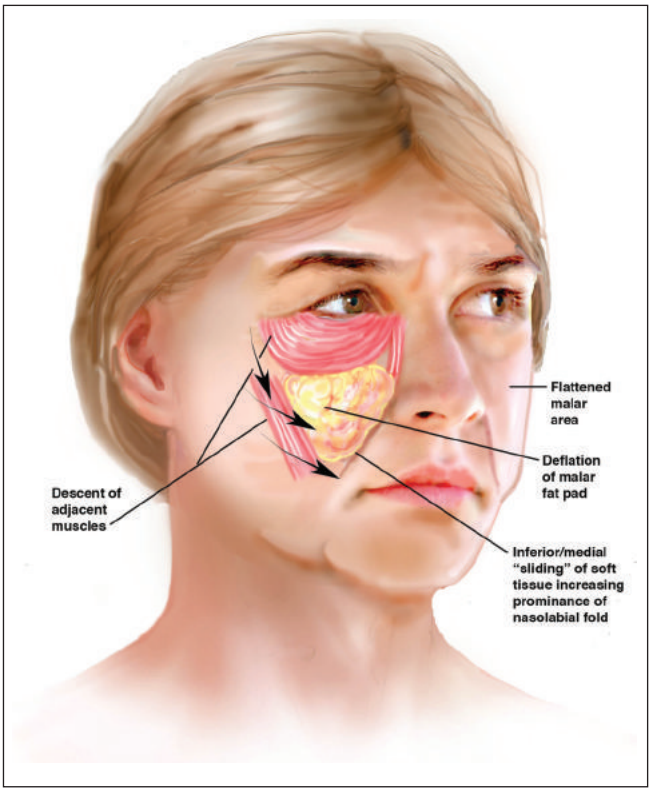

Figure 2. Midface aging occurs as a result of deflation of the malar fat pad, with an inferior medial sliding of the tissue, skin laxity, and descent of the adjacent muscle. These changes increase the prominence of the nasolabial fold and the appearance of flattening in the malar area. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery*. 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

folds was by direct excision.[1] These are just examples of the many approaches to surgical rejuvenation of the midface, which include facelift, lower eyelid incision, open temporal incision, and endoscopic temporal incision with or without oral incision. Even barbed sutures have been used for fixation.

Midface aging is characterized by several anatomic changes that fundamentally affect facial appearance. The malar fat pad appears to be the key anatomic feature in this process.[1,8-10] Gamboa et al[10] noted that the central third of the face is defined by a triangle, with its base at the forehead hairline and its apex at the tip of the chin. As the face ages, the malar fat pad becomes loose and thin and slides downward, accentuating the aged appearance.[11] As the tissue slowly migrates caudally, other anatomic changes occur. These include a virtual increase in the vertical length of the lower eyelid, with development of tear-trough deformity, and an increase in the "pseudoherniation" of the lower eyelid in pockets due to lack of soft-tissue support (malar fat pad deflated). Initially, pseudoherniation occurs from laxity of the lower eyelid structures (septum and fat pads) and increased prominence of the nasolabial folds.

Clinically, midface aging is easily discernible. "Flattening" of the midface is apparent in oblique facial views (Figures 1 and 2). The so-called descent of the malar fat pad has been described by Lambros,[12] who prefers to call it a "deflation wave" of that anatomic structure. This is due to loss of fat volume, paralleling the nasolabial fold and moving obliquely from lateral to medial.[10]

The present report summarizes our 13 years of experience with the endoscopic midface lift and describes our preferred technique for this surgery. Their approach includes careful preoperative evaluation and planning, including detailed assessment of the position, shape, and volume of the midface.

METHODS

Study Design

A retrospective chart review was conducted of 183 consecutive patients treated between 1998 and 2012 by one surgeon (RS). All patients underwent an endoscopic midface lift. Patients treated in the first 6 years of the study period (n = 95) received direct needle fixation. Those treated more recently (n = 88) underwent fixation with an Endotine midface device (Microaire, Charlottesville, Virginia).

Institutional review board approval was not obtained for this study.

Patient Selection

Inclusion criteria. Appropriate candidates for the endoscopic midface lift were those who presented with accentuation of the nasolabial groove, ptosis at the corner of the mouth, ptosis at the lateral corner of the eyelid, sliding of the orbital rim, loss of projection (flattening) of the malar area, accentuated nasojugal groove(s), and/or ptosis of the tail of the brow (without excess skin).

Contraindications for endoscopic midface lift. Patients who had any of the above features accompanied by excess skin were not considered candidates for the endoscopic midface lift. (They were considered candidates for a full facelift.) Other contraindications for endoscopic midface surgery included prominent malar bones, lack of tissue volume to restore midface fullness, and sagging of the lower face and neck, which required rhytidectomy and/or cervicoplasty.

Patient Preparation

After asepsis and antisepsis with betadine, the hair was divided with elastic ties, revealing the sample locations for the incisions. Hair was prepared without shaving. Markings were made over the hair-bearing scalp and forehead. Analgesia consisted of general anesthesia or local infiltration. A mixture of 20 mL of 2% plain lidocaine, 20 mL of 0.5% plain bupivacaine, and 1 mL epinephrine (1:1000) solution was combined with 160 mL of cold sterile saline solution.

Zone descriptions and markings. Three zones of dissection were outlined. For midface surgery, zones 1 and 3 are very important. Landmarks for the endoscopic midface lift are the inferior orbital rim, the zygomatic arch, and the nasolabial folds.

Zone 1. This zone comprises the temporal region extending medially to the temporal crest, inferiorly to the supraorbital rim, and downward along the lateral orbital rim and the superior border of the zygomatic arch. The floor of zone 1 is the temporalis muscle and the deep temporal fascia. The roof consists of the superficial temporal fascia. Dissection at this level is suprafascial (top of the deep temporal fascia).[11]

Zone 2. This zone is limited laterally by the 2 temporal crests, inferiorly by the supraorbital rims and nose, and superiorly to the level of the incisions. Dissection in this zone is subperiosteal. Zones 1 and 2 are connected by releasing the areolar tissue at the level of the temporal crest.[11]

Zone 3. This zone consists of the lateral and inferior orbital rim, malar bone, and the premaxilla. Dissection is subperiosteal, under the malar fat pad.[11]

Various points and lines were drawn prior to surgery; for example, point A was 3 cm lateral to the lateral orbital rim at the level of the superior zygomatic arch. Another line, extending from the distal orbital third of the nasolabial fold, was used to define the area of subperiosteal dissection.

The anterior temporal line also was marked. A line from the inferior earlobe to the lateral corner of the lateral brow outlined the temporal branch of the facial nerve trajectory. Other lines were drawn from the superior zygomatic arch at the lateral corner of the eye to outline the transition from the temporal area to the midface.[11] Finally, a line was made 2 cm above the superior orbital rim that crossed the frontal area and divided into 2 parts (Figure 3).

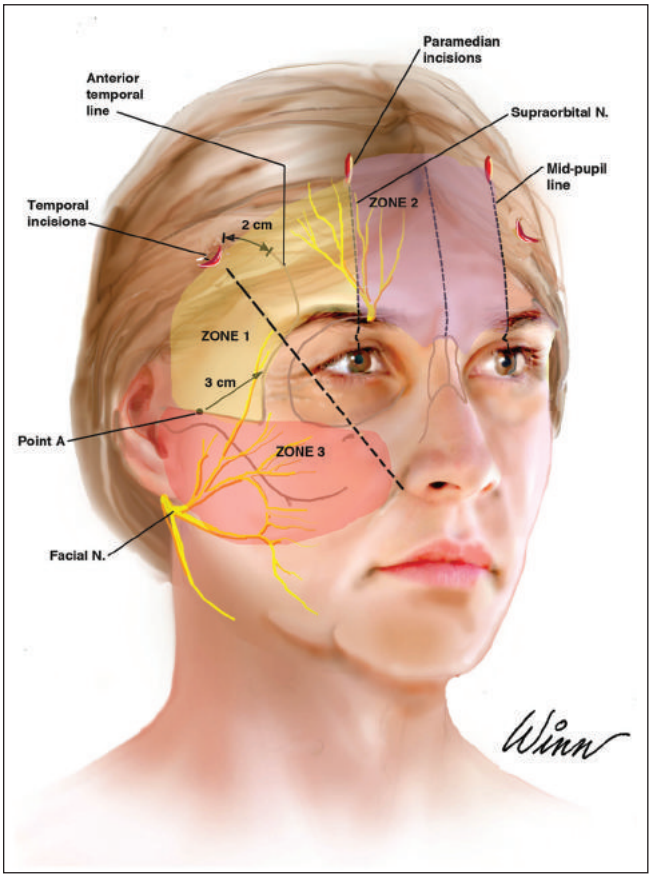

Figure 3. Marking and incisions. Two temporal incisions are made, with 2 paramedian incisions at the mid-pupil line. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery*. 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

Surgical Technique

Equipment. The endoscopic system included a 4-mm 30° "angle" scope, endoscopic periosteal dissectors, subperiosteal hockey-stick elevators, an endoscopic grasper, endoscopic scissors, cautery and suction, and the Endotine midface fixation device.

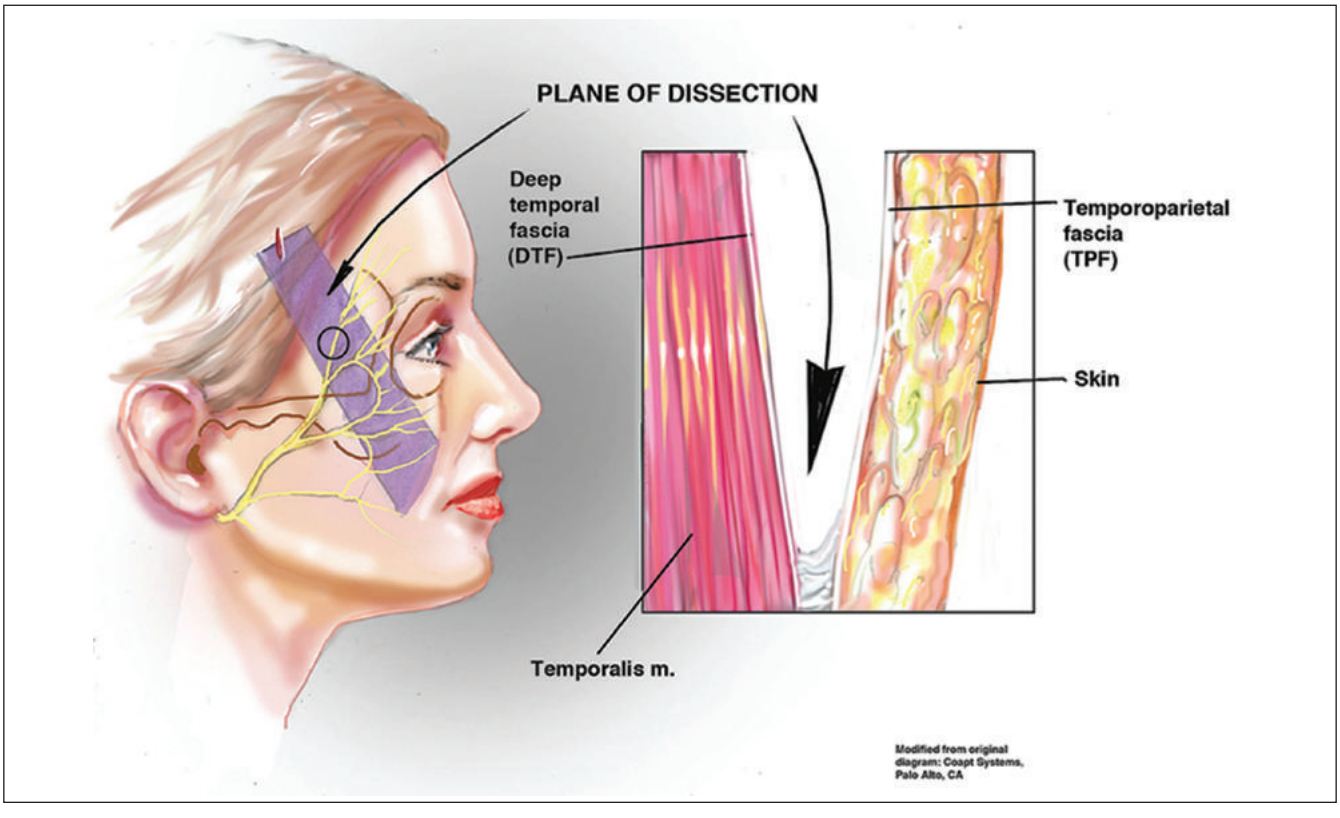

Figure 4. The plane of dissection is below the superficial temporal fascia and above the deep temporal fascia. Adapted from artwork from Coapt Systems, Inc (Palo Alto, California).

Incisions. Temporal incisions were made approximately 2 cm behind the hairline, in the coronal direction, corresponding to a line of the lateral wing of the nose, passing through the lateral canthus, and reaching the hair-bearing scalp. Paramedian incisions were made at the mid-pupil line of the hair-bearing scalp (Figure 3).

Dissection. Open dissection was performed superficial to the deep temporal fascia (white glistening tissue). In the event of uncertainty about the correct plane, a small incision was placed on the fascia to visualize the temporal muscle.

Blunt dissection continued downward to the point of resistance, at the level of the supraorbital rim. The endoscope was introduced in the cavity to allow better visualization, safer dissection, and adequate hemostasis. Medially, the dissection continued through the areolar tissue, connecting the deep temporal fascia with the subperiosteal plane (fusion line). Dissection continued along the areolar plane until reaching the supraorbital rim and the superior border of the zygomatic arch. (This plane is below the superficial temporal fascia and above the deep temporal fascia. The temporal branch of the facial nerve is superficial to this plane of dissection.) At this point, the sentinel veins were identified and left intact if possible. Release of the fusion line (junction of periosteum and deep temporal fascia) and the supraorbital rim periosteum allowed entry into zone 3 of the midface. (The temporal branch of the facial nerve is superficial to this plane of dissection.) The supraorbital rim was identified. The lateral dissection above the deep temporal fascia extended down along the lateral orbital rim into the malar region in a subperiosteal plane, inferiorly and medially to the infraorbital region. The infraorbital nerve was visualized medially and preserved (Figures 4 and 5).

The masseter fibers attached to the malar bone were identified and divided. This facilitated suspension and prevented early relapse. The inferior border of dissection, located superior to the gingival sulcus, was the point at which complete release of the periosteum was achieved. In this location, the nasolabial folds were treated by undermining fat injection and/or suspension.

Fixation and closure. Fixation did not begin until complete undermining had been achieved. From 1998 to 2003, fixation for midface lifting was achieved using the direct needle technique. Since 2003, the Endotine device has been used for fixation. By sliding an introducer—a deployment system that protected the Endotine implant during insertion—elevation of soft tissues was achieved with a simple trigger release to engage the tines to the soft tissue. (The tines were engaged by digital pressure on the soft tissue.) The insertion tool was then removed, and the sheath of the device was fixed to the deep temporal fascia with permanent sutures (3-0 Mersilene; Ethicon, Inc, Cincinnati, Ohio; Figure 6). Excess sheath material was removed and discarded. Tissue sealant was sprayed inside the dissected pocket to seal lymphatics in the "dead space," which decreased bruising and swelling. The scalp

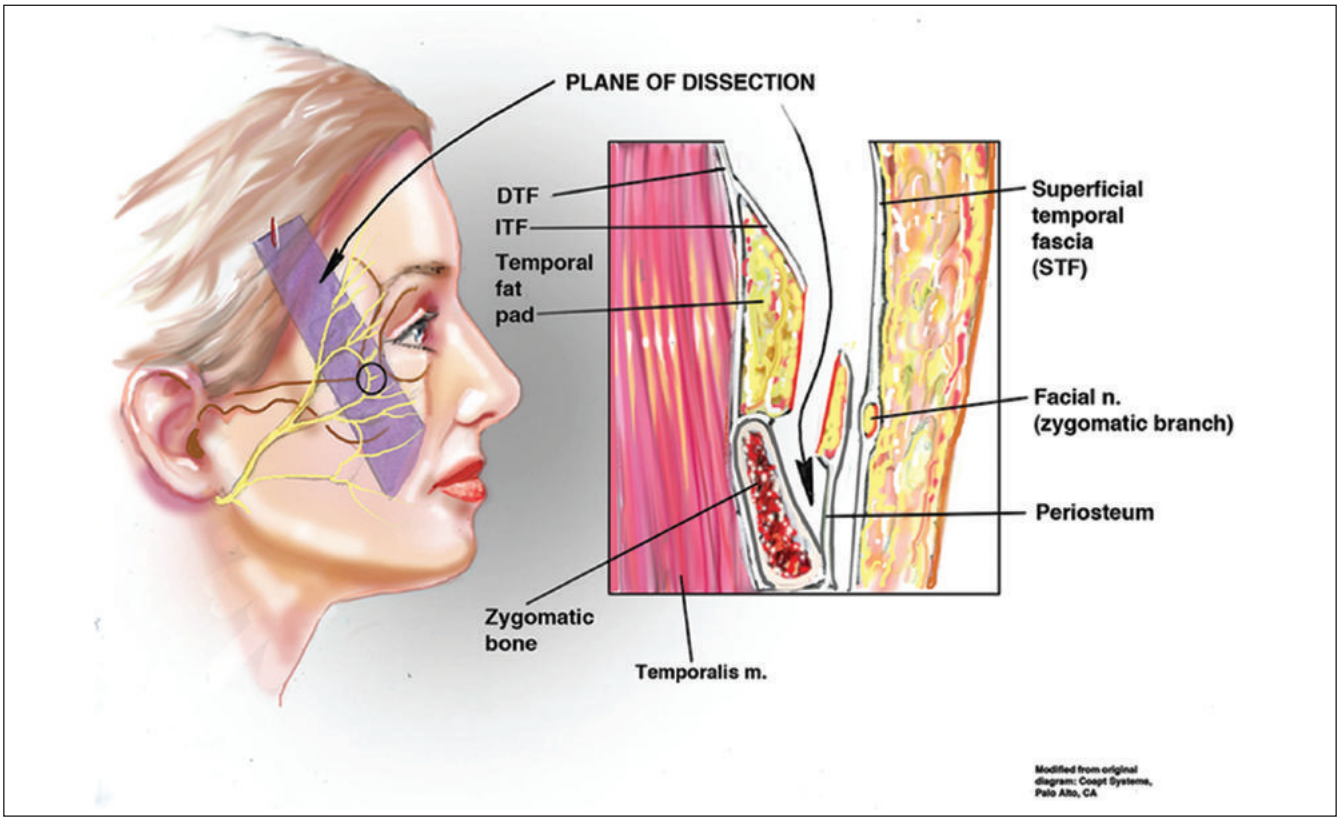

Figure 5. The transition between the suprafascial plane and the subperiosteal plane. Lateral dissection begins above the deep temporal fascia extends down along the lateral orbital rim into the malar region in a subperiosteal plane. Adapted from artwork from Coapt Systems, Inc (Palo Alto, California).

Figure 6. Fixation. The soft tissue is engaged, the insertion tool is removed through the temporal incision, and tension is applied to the anchoring lashes to achieve the desired elevation. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery.* 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

Table 1. Postoperative Instructions for Patients

Taping and dressings removed 24-48 hours postoperatively
Head elevated for 48 hours to minimize swelling
High blood pressure controlled with medication and monitored by an anesthesiologist to avoid bleeding and hematoma
Cold compresses over the eyes for 48-72 hours
Analgesia for first 24 hours, then as needed
Shower and shampoo 24-48 hours postoperatively
Lymphatic drainage massage 72 hours postoperatively, once or twice during the first week, then 2-3 times a week

incisions were closed in 2 planes using absorbable sutures (4-0 plain gut).

Postoperative instructions are summarized in Table 1.

RESULTS

The retrospective study population comprised 183 patients who had undergone an endoscopic midface lift between 1998 and 2012. Ninety percent were female, and the mean age at

Figure 7. (A, C, E) This 38-year-old woman was an excellent candidate for forehead and midface rejuvenation. (B, D, F) One year after endoscopic brow and midface lift performed through temporal incisions only. Endotine devices were used for fixation, and fibrin glue was sprayed in the midface pocket to minimize swelling and bruising. Through elevation of the malar fat pad, the midface was rejuvenated and "jowling" was minimized.

the time of surgery was 46 years (range, 39-54 years). Needle fixation was used in 95 patients and Endotine fixation in 88. The average follow-up period was 7 years.

Needle fixation (used from 1998-2003) was associated with several disadvantages, including increased surgical time, postoperative midface asymmetry, and patient dissatisfaction owing to dimpling at the suture point of suspension to the cheek area (which occurred in some cases). The Endotine midface device (used from 2003-2012) has eliminated many problems associated with needle fixation. Individual percutaneous sutures, containing just 1 fixation point, have been replaced by a 5-prong (tine) system that engages the soft tissue to suspend and be secured in the proper position.

In patients who underwent the endoscopic approach only (without oral incisions) along with Endotine fixation, there was reduced swelling and bruising, more symmetric elevation of the malar fat pad, mild improvement of tear trough deformity, softening of the nasolabial folds, and decreased jowling (in some patients). The asymmetry that often occurred with direct needle fixation has decreased, with complete absence of skin dimpling. The reduction in swelling and bruising may be attributable in part to the tissue glue utilized in conjunction with the Endotine device. (The glue was not used with needle fixation.) It appeared that the glue played a role in decreasing postoperative hematoma and edema. In some cases, it facilitated earlier recovery and greater patient satisfaction.

The most common complication in this study was temporary paresthesia of the frontal branch nerve, which usually resolved within 6 weeks. This occurred in 50% of patients and resolved spontaneously in all of them. The

Figure 7. (continued) (A, C, E) This 38-year-old woman was an excellent candidate for forehead and midface rejuvenation. (B, D, F) One year after endoscopic brow and midface lift performed through temporal incisions only. Endotine devices were used for fixation, and fibrin glue was sprayed in the midface pocket to minimize swelling and bruising. Through elevation of the malar fat pad, the midface was rejuvenated and "jowling" was minimized.

incidence of paresthesia was similar for both methods of fixation. This appears to relate more to extensive pocket dissection and stretching of the soft tissues than to fixation itself. Persistent edema and ecchymosis can occur up to 3 weeks postoperatively. Patients with this complication were instructed to avoid sun exposure and continue lymphatic drainage massage. Hematoma did not occur in this study. It is avoidable by ensuring adequate surgical technique, proper hemostasis, and effective control of blood pressure during surgery and early in the postoperative period. There has been no surgical revision for asymmetry since 2003, when the Endotine device was introduced into our practices. Previously, when the intraoral approach was used, the revision rate was 10%. Some revisions and complications can be addressed and resolved endoscopically.

In the current study, Endotine fixation was superior to needle fixation. Endotine fixation was associated with fewer complications, better outcomes, longer-lasting results, and a shorter learning curve. The technique was easily reproducible. Patients recovered more quickly, and their scars were smaller and less conspicuous. Other advantages included a safe plane of dissection, easy combination with an endoscopic browlift, excellent visualization of anatomic structures, direct fixation, and avoidance of an intraoral incision (which decreases the risk of infection).

Clinical results are shown in Figures 7 and 8. Additional images are available in an online-only appendix at www.aestheticsurgeryjournal.com.

DISCUSSION

The initial signs of facial aging, which typically appear in a person's late 30s or early 40s, are attributable to genetics, environmental reasons, and gravitational migration.[8] Patients who are relatively young (≤55 years of age) are ideal candidates for simpler, less-invasive surgical procedures such as the endoscopic midface lift. Minimally invasive surgery generally results in shorter downtime, less scarring, and faster overall recovery.

Detailed patient analysis is essential for selecting appropriate candidates for endoscopic facial surgery. In our facial rejuvenation practice, patients are classified into 1 of 3 categories to properly evaluate their facial aging and determine whether an endoscopic technique would be indicated.

Type 1: Younger patients (between 30 and 40 years of age) with temporal hooding, brow asymmetry, hyperactive frontalis muscle, and hyperactive corrugator muscle are ideal candidates for the endoscopic browlift.

Type 2: These patients have type 1 components plus descent of the malar fat pad, tear trough deformity, descent of the lid-cheek junction (with illusion of increased vertical height of the lower lid), increase in prominence of the nasolabial folds, and loss in

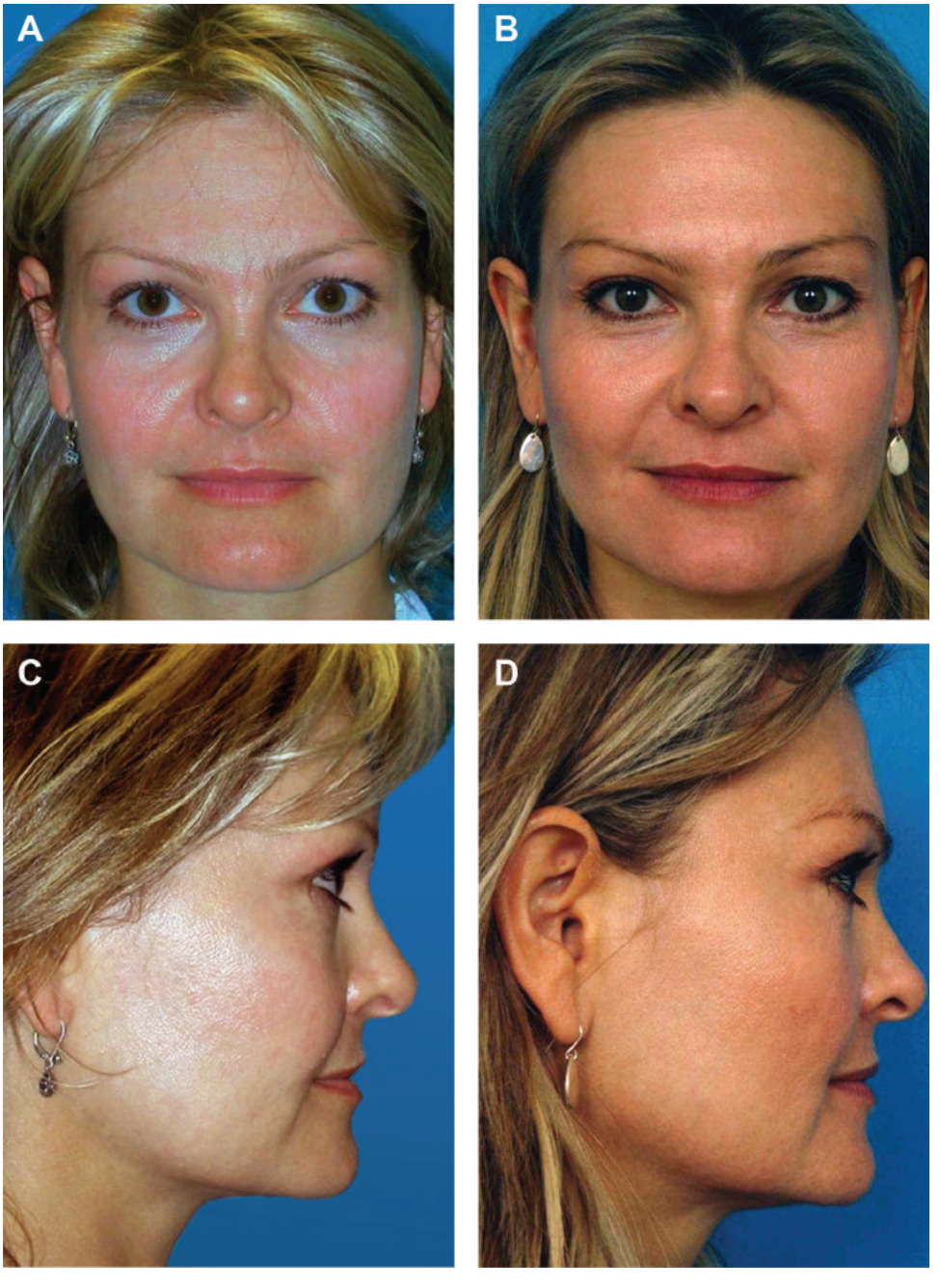

Figure 8. (A, C) This 41-year-old woman desired facial rejuvenation. (B, D) Two years after endoscopic brow and midface lift through temporal incisions only, with Endotine devices used for fixation. Elevation of the malar fat pad resulted in facial rejuvenation.

cheek projection, with "flattening" of the midface. Type 2 patients are ideal candidates for an endoscopic midface lift (via temporal incisions only) and an endoscopic browlift. Some patients in this category may not require the browlift.

Type 3: These patients have some features of types 1 and 2, as well as accentuated jowls and platysmal bands, skin laxity, and excess skin on the face and/or neck. These patients benefit from rhytidectomy, the submuscular aponeurotic system (SMAS) lift, and platysmal plication through a submental incision, in combination with an endoscopic browlift.

There are many approaches to midface lifting: tear trough and lower eyelid incisions, conventional facelift with preauricular and retroauricular incision, open temporal incision, infraorbital rim, zygoma-anchor endoscopic temporal, oral incision, deep temporal lift with preperiosteal

plane,[13] and endoscopic temporal-only approaches, as well as treatment with barbed sutures. Sasaki[14] and Hester et al[15] have described midface lift techniques, such as Sasaki's Gore-Tex (W. L. Gore & Associates, Newark, Delaware) suture suspension, McCord's midcheek lift, and the concentric malar lift. All of these are viable options for rejuvenating the midface. In addition, many minimally invasive and nonsurgical procedures have been used to counteract midface aging. Some authors[1,16] have popularized structural fat grafting and other injectables for augmentation of the midface.

The lower eyelid approach to midface surgery has disadvantages owing to its complexity. Ectropion has been observed after removal of excess skin, and damage has occurred to the orbicularis oculi muscle. Oral incisions can lead to infection and are not indicated with use of the Endotine device. Also, dermal fillers can be unpredictable and their results are not long lasting. Fillers may appear artificial and are not capable of repositioning soft tissue. Barbed sutures provide only limited improvement.

Several advantages to Endotine fixation (vs needle fixation) were observed in the present study. These include a safe dissection plane, easy combination with the endoscopic browlift, improved visualization of anatomic structures, less bruising, and better long-term cosmetic results. Through experience, our preferred technique for midfacial rejuvenation has become the endoscopic temporal approach, with fixation by the Endotine device. This Endotine device is bioabsorbable, and its unique leash fixation mechanism provides fast and simple adjustability for optimal control of midface elevation. Patients do not feel the device, and it absorbs completely within 12 months.

Adequate fixation is the key component of the endoscopic midface lift. It prevents early recurrence and facial asymmetry and provides long-lasting results. In a study of periosteal adherence in rabbits, Romo et al[17] demonstrated partial adherence at 6 weeks and permanent adherence at 12 weeks. In 2003, Scalafani et al[18] recommended a minimum of 6 weeks for "significant readherence" of the elevated periosteum to the underlying bone. Boutros et al[19] investigated periosteal adherence in guinea pigs and concluded that fixation must remain stable for at last 30 days to enable adequate adherence between bone and periosteum at the postoperative position. Some authors emphasized that the key question was not when the periosteum became "adherent" but when the fixation became "durable."[20] They indicated that, according to clinical and laboratory evidence, fixation is needed for a "substantially longer period than 2 weeks postoperatively, probably for 2 to 3 months."

Although the use of tissue sealant proved favorable in the current study, it has been shown by others, including Marchac,[21] to not reduce swelling or bruising and to increase the risk of mini-hematoma, leading to irregularities. The decreased swelling/bruising and faster recovery times noted in the present study are supported by other studies, including another study by the senior author (RS).[22]

In the present study, satisfactory long-term results were achieved with Endotine absorbable fixation, as evidenced by the low reoperation rate. The Endotine device remained stable for more than the recommended 2 to 3 months required for proper adherence of the periosteum to the frontal bone.

Also, Endotine fixation was associated with greater patient satisfaction and fewer complications than needle fixation. Although better outcomes were achieved when the Endotine device was used in our hands, we are not making general claims that this technique is superior to any other method of fixation.

CONCLUSIONS

This study showed more favorable results for Endotine fixation relative to needle fixation. The Endotine device was associated with a shorter learning curve, fewer complications, better outcomes, and longer-lasting results. The device enhances soft-tissue fixation, provides simple adjustability for optimal elevation and projection, and maintains mechanical fixation until biologic fixation is adequate. The 5 tines provide multiple points of contact for secure soft-tissue fixation. The elevation forces are evenly distributed over a wide area, which eliminates skin irregularities. Insertion and deployment are easily accomplished through temporal incisions.

Disclosures

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Thirteen Years of Experience With the Endoscopic Midface Lift

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Thirteen Years of Experience With the Endoscopic Midface Lift

Renato Saltz, MD; and Bianca Ohana, MD

Abstract

Background: Numerous techniques have been used to rejuvenate the aging midface. The Endotine midface technique involves an endoscopic temporal approach, including midface dissection and malar suspension with fixation. The Endotine device (Microaire, Charlottesville, Virginia) eliminates the intraoral incision and use of sutures, enabling multipoint fixation and fast, simple adjustability for optimal control of midface elevation and volume.
Objectives: The authors describe their preferred technique for the endoscopic midface lift and summarize their 13 years of experience.
Methods: A retrospective chart review was conducted of 183 patients who underwent endoscopic midface surgery. Patients treated from 1998 to 2003 received direct needle fixation (n = 95). Those treated later underwent fixation with the Endotine device (n = 88).
Results: Most (90%) of the patient population was female, and the average age at the time of surgery was 46 years (range, 39-54 years). Needle fixation was used in 95 patients and Endotine fixation in 88. The average follow-up period was 7 years. The authors have observed many improvements in outcomes since the introduction of the Endotine device into their practice. These include reduced swelling and bruising, more symmetric elevation of the malar fat pad, mild improvement of tear trough deformity, softening of the nasolabial folds, and, in some cases, decreased "jowling." The asymmetry often associated with direct needle fixation has decreased, and no skin dimpling has occurred. Through their experience, the authors' preferred technique has become the temporal-only approach with Endotine fixation.
Conclusions: The Endotine midface suspension device enhances soft-tissue fixation, provides simple adjustability for optimal elevation and projection, and maintains mechanical fixation until biologic fixation becomes adequate. The 5 tines provide multiple points of contact for secure soft-tissue fixation. Elevation forces are evenly distributed over a wide area, which eliminates skin irregularities. Insertion and deployment are accomplished easily through temporal incision.

Level of Evidence: 4

Keywords

facial surgery, facelift, midface, endoscopic, Endotine, aging process, malar fat pad

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Techniques for aesthetic rejuvenation of the face, which have continued to improve with time and experience, are a major focus of plastic surgeons, patients, and the media. In recent years, many surgical techniques have been introduced, along with modifications to existing procedures. Modern trends emphasize long-lasting results with smaller scars.

Successful midface rejuvenation depends on understanding patient concerns, establishing an accurate diagnosis, and executing a safe and appropriate treatment plan.[1] To achieve optimal results, it is essential to have a thorough understanding of the anatomy and pathophysiology of midface aging. Many authors, including Hester et al,[2] Paul,[3] Ramirez,[4] Hamra,[5] and Mendelson et al,[6] have clearly defined the anatomic structures and findings common to midface aging and have described various treatment options. In a 2008 publication, Downs and Wang[1] highlighted some of these authors' findings. For instance, Hester et al[7] described the elements of midfacial aging as gradual ptosis of the cheek skin below the infraorbital rim (creating a skeletonized appearance with infraorbital hollowness), descent of the malar fat pad with loss of malar prominence, deepening of the tear trough, and exaggeration of the nasolabial fold.[1] Hamra,[5] upon reviewing his own work, believed that the only way to correct nasolabial

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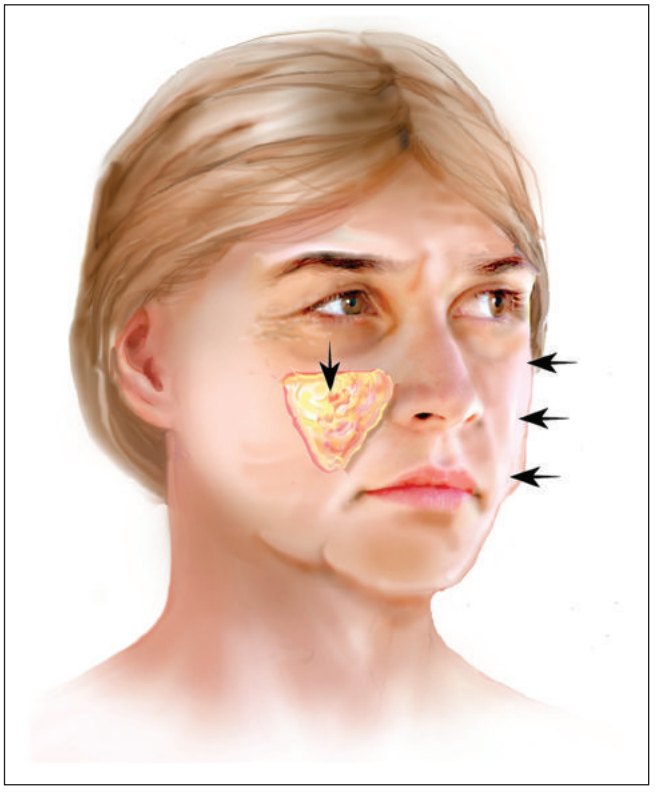

Figure 1. Midface aging process at the beginning: descent and deflation of the malar fat pad. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery*. 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

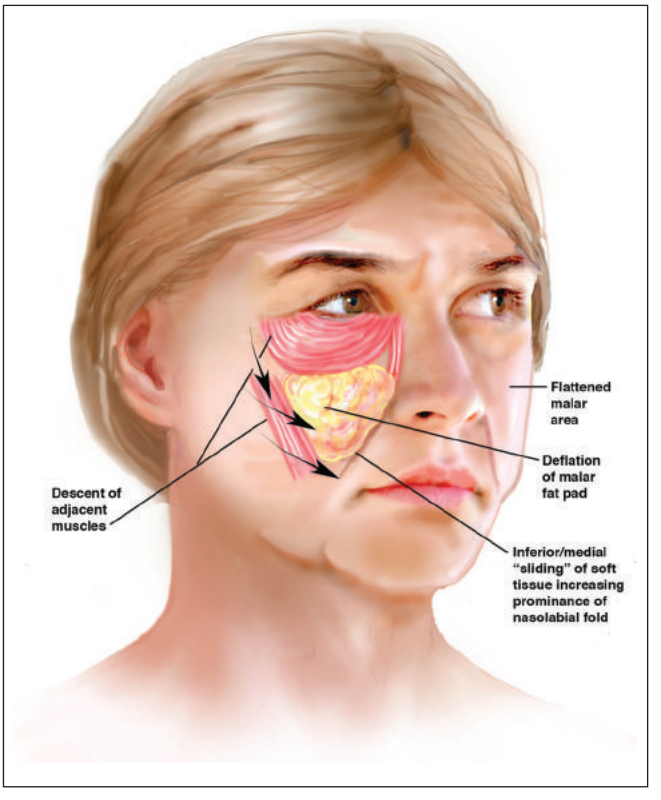

Figure 2. Midface aging occurs as a result of deflation of the malar fat pad, with an inferior medial sliding of the tissue, skin laxity, and descent of the adjacent muscle. These changes increase the prominence of the nasolabial fold and the appearance of flattening in the malar area. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery*. 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

folds was by direct excision.[1] These are just examples of the many approaches to surgical rejuvenation of the midface, which include facelift, lower eyelid incision, open temporal incision, and endoscopic temporal incision with or without oral incision. Even barbed sutures have been used for fixation.

Midface aging is characterized by several anatomic changes that fundamentally affect facial appearance. The malar fat pad appears to be the key anatomic feature in this process.[1,8-10] Gamboa et al[10] noted that the central third of the face is defined by a triangle, with its base at the forehead hairline and its apex at the tip of the chin. As the face ages, the malar fat pad becomes loose and thin and slides downward, accentuating the aged appearance.[11] As the tissue slowly migrates caudally, other anatomic changes occur. These include a virtual increase in the vertical length of the lower eyelid, with development of tear-trough deformity, and an increase in the "pseudoherniation" of the lower eyelid in pockets due to lack of soft-tissue support (malar fat pad deflated). Initially, pseudoherniation occurs from laxity of the lower eyelid structures (septum and fat pads) and increased prominence of the nasolabial folds.

Clinically, midface aging is easily discernible. "Flattening" of the midface is apparent in oblique facial views (Figures 1 and 2). The so-called descent of the malar fat pad has been described by Lambros,[12] who prefers to call it a "deflation wave" of that anatomic structure. This is due to loss of fat volume, paralleling the nasolabial fold and moving obliquely from lateral to medial.[10]

The present report summarizes our 13 years of experience with the endoscopic midface lift and describes our preferred technique for this surgery. Their approach includes careful preoperative evaluation and planning, including detailed assessment of the position, shape, and volume of the midface.

METHODS

Study Design

A retrospective chart review was conducted of 183 consecutive patients treated between 1998 and 2012 by one surgeon (RS). All patients underwent an endoscopic midface lift. Patients treated in the first 6 years of the study period (n = 95) received direct needle fixation. Those treated more recently (n = 88) underwent fixation with an Endotine midface device (Microaire, Charlottesville, Virginia).

Institutional review board approval was not obtained for this study.

Patient Selection

Inclusion criteria. Appropriate candidates for the endoscopic midface lift were those who presented with accentuation of the nasolabial groove, ptosis at the corner of the mouth, ptosis at the lateral corner of the eyelid, sliding of the orbital rim, loss of projection (flattening) of the malar area, accentuated nasojugal groove(s), and/or ptosis of the tail of the brow (without excess skin).

Contraindications for endoscopic midface lift. Patients who had any of the above features accompanied by excess skin were not considered candidates for the endoscopic midface lift. (They were considered candidates for a full facelift.) Other contraindications for endoscopic midface surgery included prominent malar bones, lack of tissue volume to restore midface fullness, and sagging of the lower face and neck, which required rhytidectomy and/or cervicoplasty.

Patient Preparation

After asepsis and antisepsis with betadine, the hair was divided with elastic ties, revealing the sample locations for the incisions. Hair was prepared without shaving. Markings were made over the hair-bearing scalp and forehead. Analgesia consisted of general anesthesia or local infiltration. A mixture of 20 mL of 2% plain lidocaine, 20 mL of 0.5% plain bupivacaine, and 1 mL epinephrine (1:1000) solution was combined with 160 mL of cold sterile saline solution.

Zone descriptions and markings. Three zones of dissection were outlined. For midface surgery, zones 1 and 3 are very important. Landmarks for the endoscopic midface lift are the inferior orbital rim, the zygomatic arch, and the nasolabial folds.

Zone 1. This zone comprises the temporal region extending medially to the temporal crest, inferiorly to the supraorbital rim, and downward along the lateral orbital rim and the superior border of the zygomatic arch. The floor of zone 1 is the temporalis muscle and the deep temporal fascia. The roof consists of the superficial temporal fascia. Dissection at this level is suprafascial (top of the deep temporal fascia).[11]

Zone 2. This zone is limited laterally by the 2 temporal crests, inferiorly by the supraorbital rims and nose, and superiorly to the level of the incisions. Dissection in this zone is subperiosteal. Zones 1 and 2 are connected by releasing the areolar tissue at the level of the temporal crest.[11]

Zone 3. This zone consists of the lateral and inferior orbital rim, malar bone, and the premaxilla. Dissection is subperiosteal, under the malar fat pad.[11]

Various points and lines were drawn prior to surgery; for example, point A was 3 cm lateral to the lateral orbital rim at the level of the superior zygomatic arch. Another line, extending from the distal orbital third of the nasolabial fold, was used to define the area of subperiosteal dissection.

The anterior temporal line also was marked. A line from the inferior earlobe to the lateral corner of the lateral brow outlined the temporal branch of the facial nerve trajectory. Other lines were drawn from the superior zygomatic arch at the lateral corner of the eye to outline the transition from the temporal area to the midface.[11] Finally, a line was made 2 cm above the superior orbital rim that crossed the frontal area and divided into 2 parts (Figure 3).

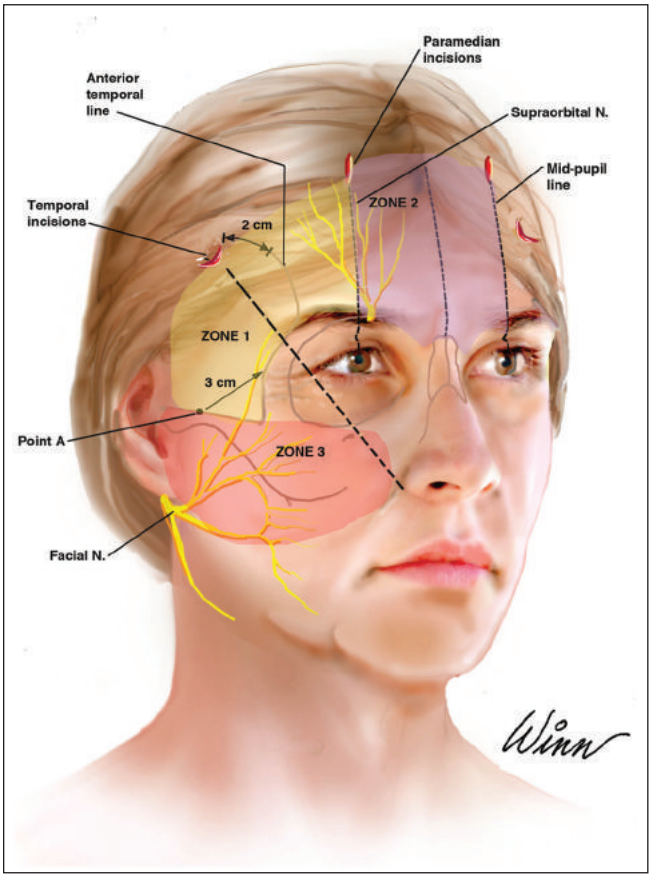

Figure 3. Marking and incisions. Two temporal incisions are made, with 2 paramedian incisions at the mid-pupil line. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery*. 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

Surgical Technique

Equipment. The endoscopic system included a 4-mm 30° "angle" scope, endoscopic periosteal dissectors, subperiosteal hockey-stick elevators, an endoscopic grasper, endoscopic scissors, cautery and suction, and the Endotine midface fixation device.

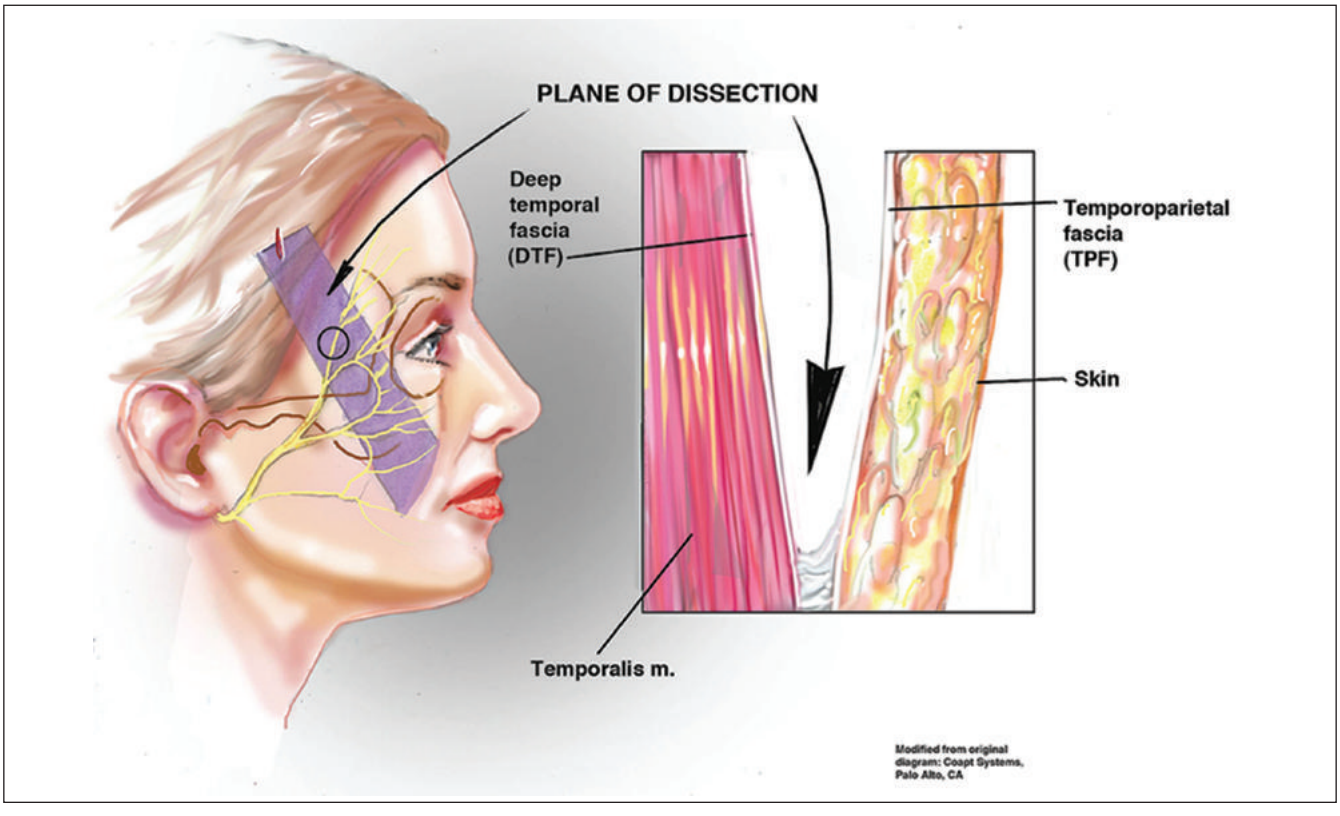

Figure 4. The plane of dissection is below the superficial temporal fascia and above the deep temporal fascia. Adapted from artwork from Coapt Systems, Inc (Palo Alto, California).

Incisions. Temporal incisions were made approximately 2 cm behind the hairline, in the coronal direction, corresponding to a line of the lateral wing of the nose, passing through the lateral canthus, and reaching the hair-bearing scalp. Paramedian incisions were made at the mid-pupil line of the hair-bearing scalp (Figure 3).

Dissection. Open dissection was performed superficial to the deep temporal fascia (white glistening tissue). In the event of uncertainty about the correct plane, a small incision was placed on the fascia to visualize the temporal muscle.

Blunt dissection continued downward to the point of resistance, at the level of the supraorbital rim. The endoscope was introduced in the cavity to allow better visualization, safer dissection, and adequate hemostasis. Medially, the dissection continued through the areolar tissue, connecting the deep temporal fascia with the subperiosteal plane (fusion line). Dissection continued along the areolar plane until reaching the supraorbital rim and the superior border of the zygomatic arch. (This plane is below the superficial temporal fascia and above the deep temporal fascia. The temporal branch of the facial nerve is superficial to this plane of dissection.) At this point, the sentinel veins were identified and left intact if possible. Release of the fusion line (junction of periosteum and deep temporal fascia) and the supraorbital rim periosteum allowed entry into zone 3 of the midface. (The temporal branch of the facial nerve is superficial to this plane of dissection.) The supraorbital rim was identified. The lateral dissection above the deep temporal fascia extended down along the lateral orbital rim into the malar region in a subperiosteal plane, inferiorly and medially to the infraorbital region. The infraorbital nerve was visualized medially and preserved (Figures 4 and 5).

The masseter fibers attached to the malar bone were identified and divided. This facilitated suspension and prevented early relapse. The inferior border of dissection, located superior to the gingival sulcus, was the point at which complete release of the periosteum was achieved. In this location, the nasolabial folds were treated by undermining fat injection and/or suspension.

Fixation and closure. Fixation did not begin until complete undermining had been achieved. From 1998 to 2003, fixation for midface lifting was achieved using the direct needle technique. Since 2003, the Endotine device has been used for fixation. By sliding an introducer—a deployment system that protected the Endotine implant during insertion—elevation of soft tissues was achieved with a simple trigger release to engage the tines to the soft tissue. (The tines were engaged by digital pressure on the soft tissue.) The insertion tool was then removed, and the sheath of the device was fixed to the deep temporal fascia with permanent sutures (3-0 Mersilene; Ethicon, Inc, Cincinnati, Ohio; Figure 6). Excess sheath material was removed and discarded. Tissue sealant was sprayed inside the dissected pocket to seal lymphatics in the "dead space," which decreased bruising and swelling. The scalp

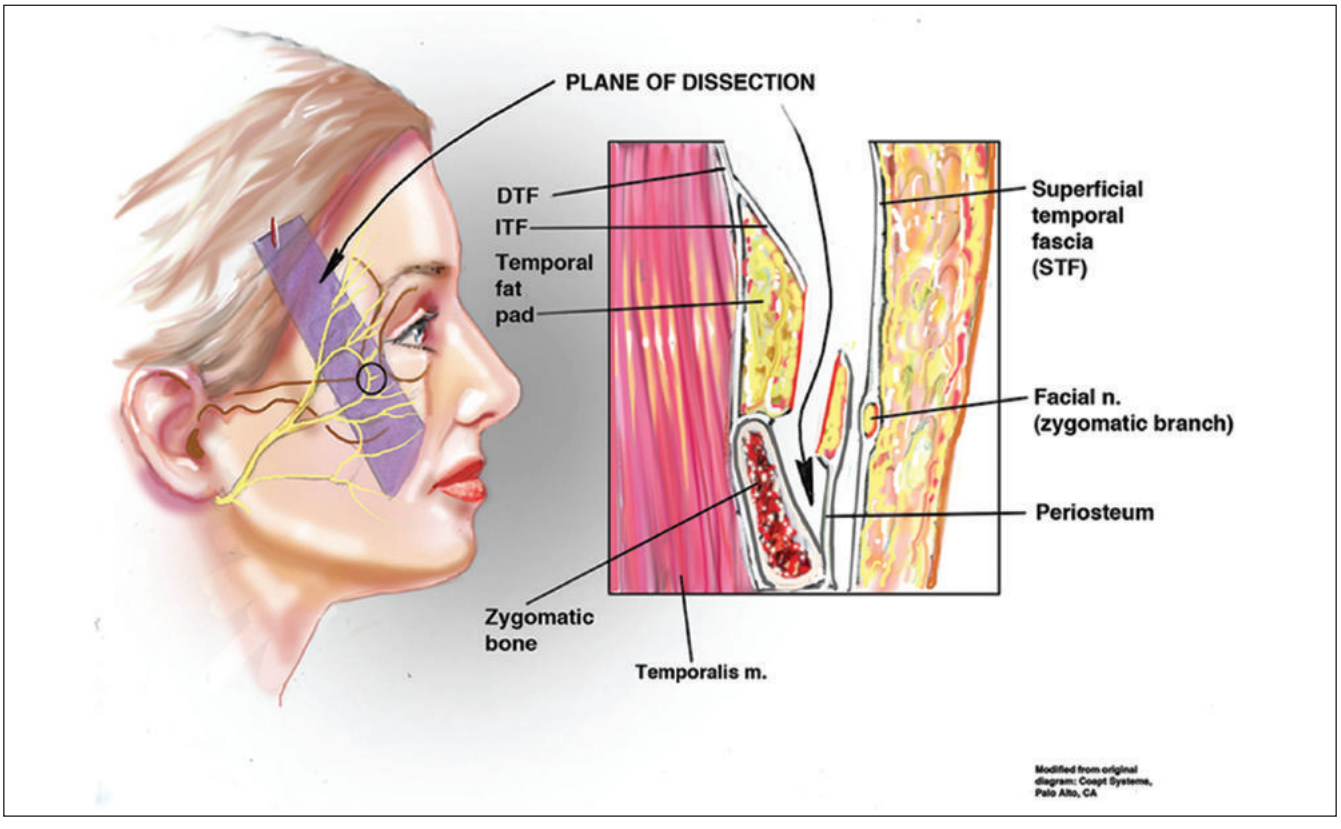

Figure 5. The transition between the suprafascial plane and the subperiosteal plane. Lateral dissection begins above the deep temporal fascia extends down along the lateral orbital rim into the malar region in a subperiosteal plane. Adapted from artwork from Coapt Systems, Inc (Palo Alto, California).

Figure 6. Fixation. The soft tissue is engaged, the insertion tool is removed through the temporal incision, and tension is applied to the anchoring lashes to achieve the desired elevation. Adapted from Nahai F, Saltz R. *Endoscopic Plastic Surgery.* 2nd ed. St Louis, MO: Quality Medical Publishing; 2008.

Table 1. Postoperative Instructions for Patients

Taping and dressings removed 24-48 hours postoperatively
Head elevated for 48 hours to minimize swelling
High blood pressure controlled with medication and monitored by an anesthesiologist to avoid bleeding and hematoma
Cold compresses over the eyes for 48-72 hours
Analgesia for first 24 hours, then as needed
Shower and shampoo 24-48 hours postoperatively
Lymphatic drainage massage 72 hours postoperatively, once or twice during the first week, then 2-3 times a week

incisions were closed in 2 planes using absorbable sutures (4-0 plain gut).

Postoperative instructions are summarized in Table 1.

RESULTS

The retrospective study population comprised 183 patients who had undergone an endoscopic midface lift between 1998 and 2012. Ninety percent were female, and the mean age at

Figure 7. (A, C, E) This 38-year-old woman was an excellent candidate for forehead and midface rejuvenation. (B, D, F) One year after endoscopic brow and midface lift performed through temporal incisions only. Endotine devices were used for fixation, and fibrin glue was sprayed in the midface pocket to minimize swelling and bruising. Through elevation of the malar fat pad, the midface was rejuvenated and "jowling" was minimized.

the time of surgery was 46 years (range, 39-54 years). Needle fixation was used in 95 patients and Endotine fixation in 88. The average follow-up period was 7 years.

Needle fixation (used from 1998-2003) was associated with several disadvantages, including increased surgical time, postoperative midface asymmetry, and patient dissatisfaction owing to dimpling at the suture point of suspension to the cheek area (which occurred in some cases). The Endotine midface device (used from 2003-2012) has eliminated many problems associated with needle fixation. Individual percutaneous sutures, containing just 1 fixation point, have been replaced by a 5-prong (tine) system that engages the soft tissue to suspend and be secured in the proper position.

In patients who underwent the endoscopic approach only (without oral incisions) along with Endotine fixation, there was reduced swelling and bruising, more symmetric elevation of the malar fat pad, mild improvement of tear trough deformity, softening of the nasolabial folds, and decreased jowling (in some patients). The asymmetry that often occurred with direct needle fixation has decreased, with complete absence of skin dimpling. The reduction in swelling and bruising may be attributable in part to the tissue glue utilized in conjunction with the Endotine device. (The glue was not used with needle fixation.) It appeared that the glue played a role in decreasing postoperative hematoma and edema. In some cases, it facilitated earlier recovery and greater patient satisfaction.

The most common complication in this study was temporary paresthesia of the frontal branch nerve, which usually resolved within 6 weeks. This occurred in 50% of patients and resolved spontaneously in all of them. The

Figure 7. (continued) (A, C, E) This 38-year-old woman was an excellent candidate for forehead and midface rejuvenation. (B, D, F) One year after endoscopic brow and midface lift performed through temporal incisions only. Endotine devices were used for fixation, and fibrin glue was sprayed in the midface pocket to minimize swelling and bruising. Through elevation of the malar fat pad, the midface was rejuvenated and "jowling" was minimized.

incidence of paresthesia was similar for both methods of fixation. This appears to relate more to extensive pocket dissection and stretching of the soft tissues than to fixation itself. Persistent edema and ecchymosis can occur up to 3 weeks postoperatively. Patients with this complication were instructed to avoid sun exposure and continue lymphatic drainage massage. Hematoma did not occur in this study. It is avoidable by ensuring adequate surgical technique, proper hemostasis, and effective control of blood pressure during surgery and early in the postoperative period. There has been no surgical revision for asymmetry since 2003, when the Endotine device was introduced into our practices. Previously, when the intraoral approach was used, the revision rate was 10%. Some revisions and complications can be addressed and resolved endoscopically.

In the current study, Endotine fixation was superior to needle fixation. Endotine fixation was associated with fewer complications, better outcomes, longer-lasting results, and a shorter learning curve. The technique was easily reproducible. Patients recovered more quickly, and their scars were smaller and less conspicuous. Other advantages included a safe plane of dissection, easy combination with an endoscopic browlift, excellent visualization of anatomic structures, direct fixation, and avoidance of an intraoral incision (which decreases the risk of infection).

Clinical results are shown in Figures 7 and 8. Additional images are available in an online-only appendix at www.aestheticsurgeryjournal.com.

DISCUSSION

The initial signs of facial aging, which typically appear in a person's late 30s or early 40s, are attributable to genetics, environmental reasons, and gravitational migration.[8] Patients who are relatively young (≤55 years of age) are ideal candidates for simpler, less-invasive surgical procedures such as the endoscopic midface lift. Minimally invasive surgery generally results in shorter downtime, less scarring, and faster overall recovery.

Detailed patient analysis is essential for selecting appropriate candidates for endoscopic facial surgery. In our facial rejuvenation practice, patients are classified into 1 of 3 categories to properly evaluate their facial aging and determine whether an endoscopic technique would be indicated.

Type 1: Younger patients (between 30 and 40 years of age) with temporal hooding, brow asymmetry, hyperactive frontalis muscle, and hyperactive corrugator muscle are ideal candidates for the endoscopic browlift.

Type 2: These patients have type 1 components plus descent of the malar fat pad, tear trough deformity, descent of the lid-cheek junction (with illusion of increased vertical height of the lower lid), increase in prominence of the nasolabial folds, and loss in

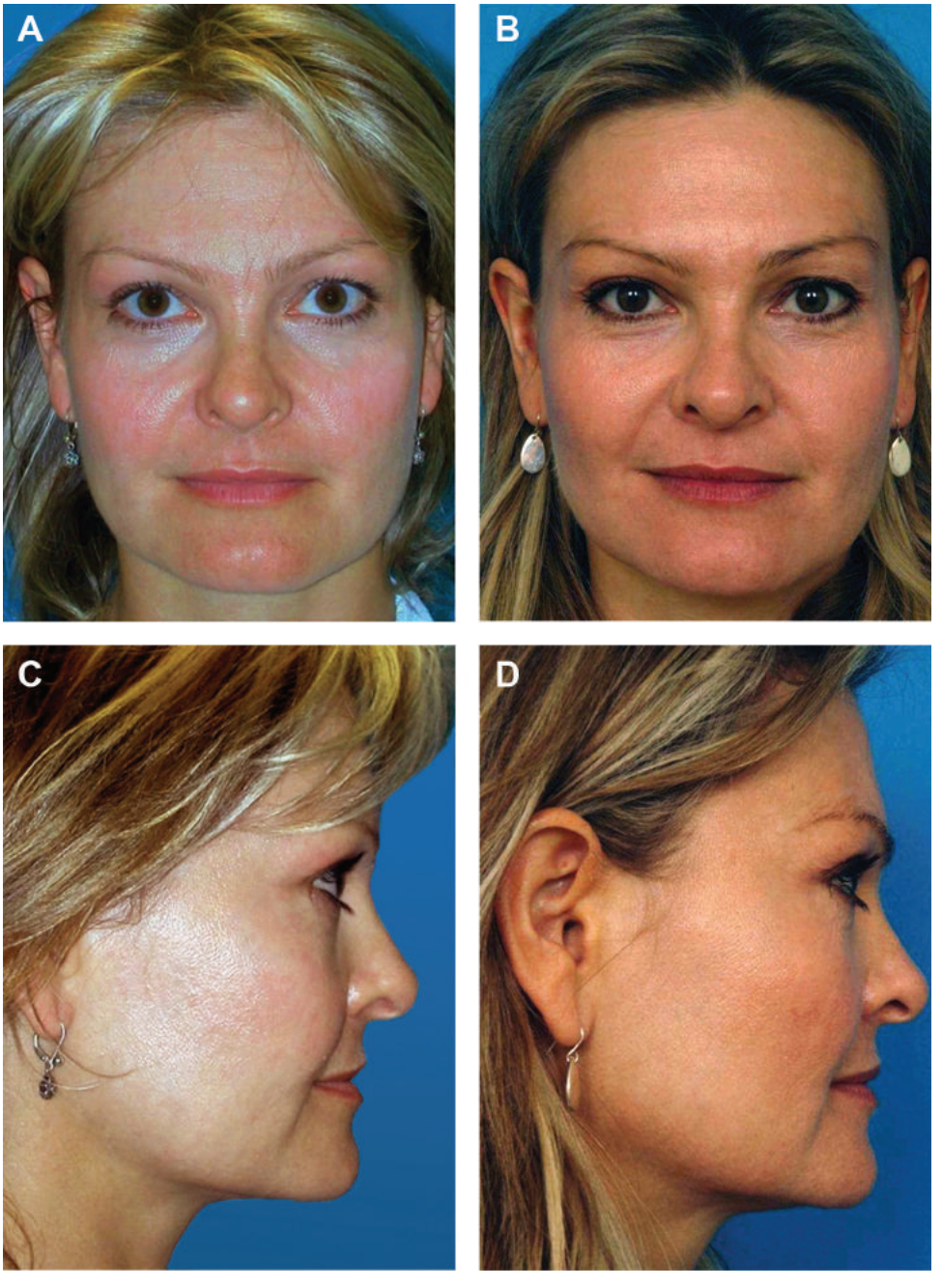

Figure 8. (A, C) This 41-year-old woman desired facial rejuvenation. (B, D) Two years after endoscopic brow and midface lift through temporal incisions only, with Endotine devices used for fixation. Elevation of the malar fat pad resulted in facial rejuvenation.

cheek projection, with "flattening" of the midface. Type 2 patients are ideal candidates for an endoscopic midface lift (via temporal incisions only) and an endoscopic browlift. Some patients in this category may not require the browlift.

Type 3: These patients have some features of types 1 and 2, as well as accentuated jowls and platysmal bands, skin laxity, and excess skin on the face and/or neck. These patients benefit from rhytidectomy, the submuscular aponeurotic system (SMAS) lift, and platysmal plication through a submental incision, in combination with an endoscopic browlift.

There are many approaches to midface lifting: tear trough and lower eyelid incisions, conventional facelift with preauricular and retroauricular incision, open temporal incision, infraorbital rim, zygoma-anchor endoscopic temporal, oral incision, deep temporal lift with preperiosteal

plane,[13] and endoscopic temporal-only approaches, as well as treatment with barbed sutures. Sasaki[14] and Hester et al[15] have described midface lift techniques, such as Sasaki's Gore-Tex (W. L. Gore & Associates, Newark, Delaware) suture suspension, McCord's midcheek lift, and the concentric malar lift. All of these are viable options for rejuvenating the midface. In addition, many minimally invasive and nonsurgical procedures have been used to counteract midface aging. Some authors[1,16] have popularized structural fat grafting and other injectables for augmentation of the midface.

The lower eyelid approach to midface surgery has disadvantages owing to its complexity. Ectropion has been observed after removal of excess skin, and damage has occurred to the orbicularis oculi muscle. Oral incisions can lead to infection and are not indicated with use of the Endotine device. Also, dermal fillers can be unpredictable and their results are not long lasting. Fillers may appear artificial and are not capable of repositioning soft tissue. Barbed sutures provide only limited improvement.

Several advantages to Endotine fixation (vs needle fixation) were observed in the present study. These include a safe dissection plane, easy combination with the endoscopic browlift, improved visualization of anatomic structures, less bruising, and better long-term cosmetic results. Through experience, our preferred technique for midfacial rejuvenation has become the endoscopic temporal approach, with fixation by the Endotine device. This Endotine device is bioabsorbable, and its unique leash fixation mechanism provides fast and simple adjustability for optimal control of midface elevation. Patients do not feel the device, and it absorbs completely within 12 months.

Adequate fixation is the key component of the endoscopic midface lift. It prevents early recurrence and facial asymmetry and provides long-lasting results. In a study of periosteal adherence in rabbits, Romo et al[17] demonstrated partial adherence at 6 weeks and permanent adherence at 12 weeks. In 2003, Scalafani et al[18] recommended a minimum of 6 weeks for "significant readherence" of the elevated periosteum to the underlying bone. Boutros et al[19] investigated periosteal adherence in guinea pigs and concluded that fixation must remain stable for at last 30 days to enable adequate adherence between bone and periosteum at the postoperative position. Some authors emphasized that the key question was not when the periosteum became "adherent" but when the fixation became "durable."[20] They indicated that, according to clinical and laboratory evidence, fixation is needed for a "substantially longer period than 2 weeks postoperatively, probably for 2 to 3 months."

Although the use of tissue sealant proved favorable in the current study, it has been shown by others, including Marchac,[21] to not reduce swelling or bruising and to increase the risk of mini-hematoma, leading to irregularities. The decreased swelling/bruising and faster recovery times noted in the present study are supported by other studies, including another study by the senior author (RS).[22]

In the present study, satisfactory long-term results were achieved with Endotine absorbable fixation, as evidenced by the low reoperation rate. The Endotine device remained stable for more than the recommended 2 to 3 months required for proper adherence of the periosteum to the frontal bone.

Also, Endotine fixation was associated with greater patient satisfaction and fewer complications than needle fixation. Although better outcomes were achieved when the Endotine device was used in our hands, we are not making general claims that this technique is superior to any other method of fixation.

CONCLUSIONS

This study showed more favorable results for Endotine fixation relative to needle fixation. The Endotine device was associated with a shorter learning curve, fewer complications, better outcomes, and longer-lasting results. The device enhances soft-tissue fixation, provides simple adjustability for optimal elevation and projection, and maintains mechanical fixation until biologic fixation is adequate. The 5 tines provide multiple points of contact for secure soft-tissue fixation. The elevation forces are evenly distributed over a wide area, which eliminates skin irregularities. Insertion and deployment are easily accomplished through temporal incisions.

Disclosures

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c0012

12

Endoscopic brow lift

Renato Saltz and Eric W. Anderson

p0035

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SYNOPSIS

u0010 ■ Advances in endoscopic brow lift technique provide a more precise and safer procedure to the aesthetic facial surgeon.

u0015 ■ Brow shape, position, and hyperactivity of the frontalis and corrugator muscles are an integral part of periocular rejuvenation.

u0020 ■ An upper blepharoplasty should not be indicated or performed for treatment of periocular aging until the brow position and symmetry is fully evaluated and treated.

u0025 ■ Modern and safe facial surgeons must incorporate endoscopic techniques in their practices – a gold standard treatment for periocular rejuvenation.

s0010

Introduction

p0040 The endoscopic approach for forehead rejuvenation and brow lift has many advantages. It provides excellent exposure for release of periorbital soft tissues combined with endoscopic magnification, shorter scars, and reduced risk of alopecia and scalp sensory changes compared with the traditional open coronal brow lift. The technique has improved over the last 15 years with better fixation devices, a better understanding of the longevity, and decreased complications of the procedure. The endoscopic brow lift offers the patient a much easier and safer solution for the aging forehead, the active wrinkles from corrugator and frontalis hyperactivity, and the ptotic, asymmetric brow (Video Lecture 12.1 LECTURE).

s0015

Anatomic considerations

p0045 The anatomy of the forehead and periorbital regions should be appreciated by the surgeon. The temporal ridge is bound by the temporal line of fusion, which is a deep bony point of fixation of the overlying soft tissues. To mobilize the lateral brow and temporal region, the temporal line of fusion should be released to the level of the supraorbital rim. There are also supraorbital ligamentous attachments that require release to elevate the brow and forehead (Fig. 12.1).

p0050 The nerves encountered during endoscopic brow lift include the two main sensory nerves, supratrochlear and supraorbital, and main motor branch of the facial nerve, the frontal branch. Care is taken to appreciate and preserve these nerves during dissection. Subgaleal dissection lateral to the temporal line of fusion will maintain the plane of dissection deep to the frontal branch. Inferior lateral dissection to the level of the sentinel veins while remaining on the superficial layer of the deep temporal fascia also protects the frontal branch from direct division or traction neuropraxia. The neurovascular bundles for the supratrochlear and supraorbital nerves exit the orbit 1.5 and 2.5 cm from midline, respectively; appreciation allows gentle division of the periosteum at the location to avoid injury to the nerves (Fig. 12.2).

p0055 The muscles of the forehead include the frontalis, procerus, corrugator supercilii with oblique and transverse heads, the depressor supercilii, and the orbicularis muscles. The sole brow elevator is the frontalis muscle while the other muscles act as varying degrees of brow depressors. While release and physical repositioning of the brow and forehead elevate the brow, division and weakening of the brow depressors also correct dynamic ptosis and glabellar frown lines (Fig. 12.3).

s0020

Brow considerations

p0060 The ideal shape and position of the brow has changed over the years through different cultures and fashions. Therefore, brow aesthetics cannot be generalized and must be evaluated in relation to gender, ethnicity, orbital shape, and overall facial aging and proportion. Currently, ideal brow aesthetics are considered to be medial brow positioned at the level of the orbital rim, above the medial canthus, with a gentle peak at the lateral limbus and the lateral tail higher than the medial (Fig. 12.4). With facial aging, the eyebrows gradually fall and

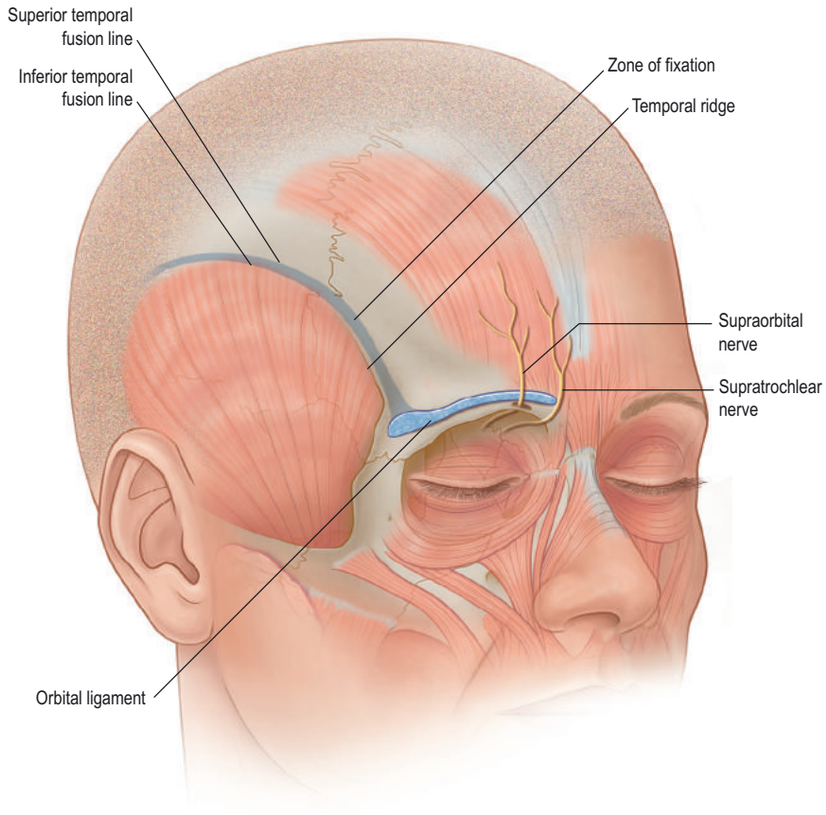


Figure 12.1 Structural landmarks in the brow. The temporal fusion line lies at the junction of the periosteum and the deep temporal fascia. It must be released to achieve brow mobility. The orbital retaining ligament, situated at the lateral supraorbital rim, must also be released. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)* f0010

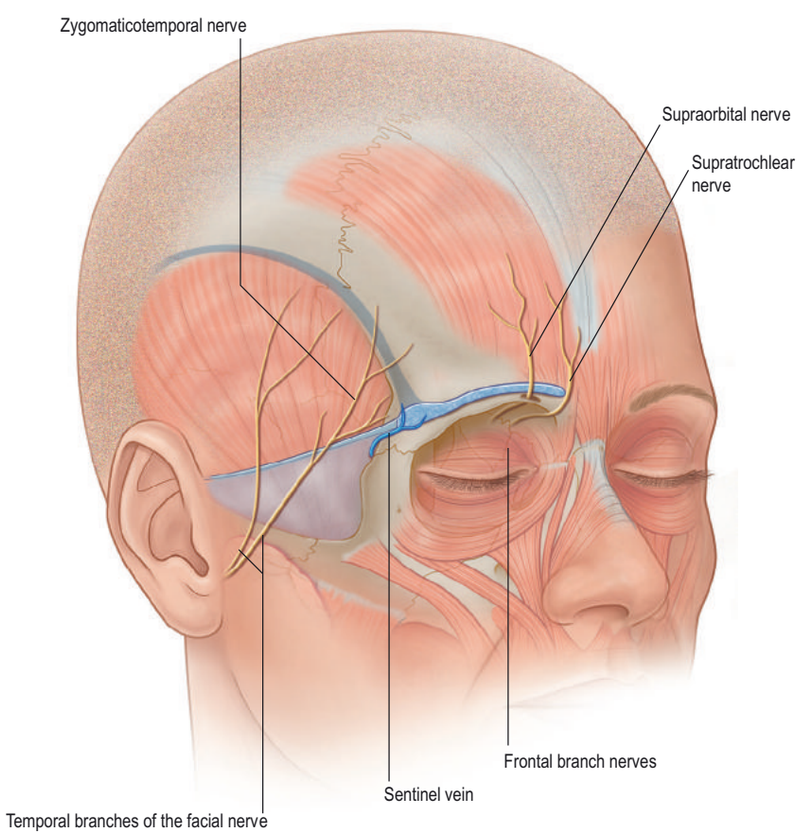
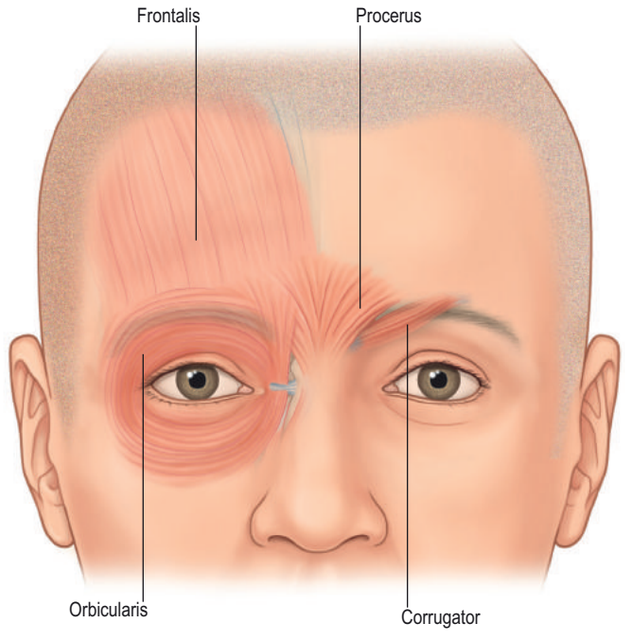
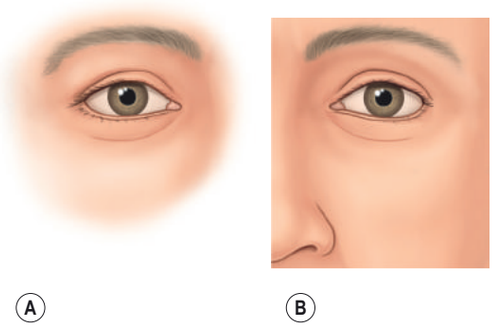


Figure 12.2 Sensory and motor nerve supply to the brow. The supraorbital and supratrochlear nerves are protected during dissection. The frontal branches of the facial nerve lie anterior to the deep temporal fascia. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)* f0015



f0020 **Figure 12.3** Brow musculature. The muscles involved with brow movement are illustrated. The corrugators and procerus contribute to vertical and transverse brow furrows, respectively. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)*



f0025 **Figure 12.4** Brow aesthetics. **(A)** The ideal brow position for females lies above the supraorbital rim with its highest peak vertically in line with the lateral limbus. **(B)** The lateral brow lies in an oblique line connecting the ala and lateral canthus. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)*

lose volume, encroaching on the orbit and bunching the skin over the lateral orbital rim, creating what is known as "temporal hooding". Eyebrow ptosis, eyebrow asymmetry, temporal hooding, and forehead wrinkles are all indications for forehead rejuvenation and a brow lift (Fig. 12.5).

Patient selection

s0025

Since the introduction of the endoscopic approach in 1993 by Core and Vasconez, implementation of open coronal brow lift has declined. Over 80% of facial rejuvenation cases today include brow lift through an endoscopic technique. The ideal candidate for endoscopic technique has a flat forehead (flat frontal bone), no receding hairline (low hairline) and no redundant forehead skin. High hairline or male pattern baldness can increase the challenge of operative visualization and the removal of glabellar muscles. p0065

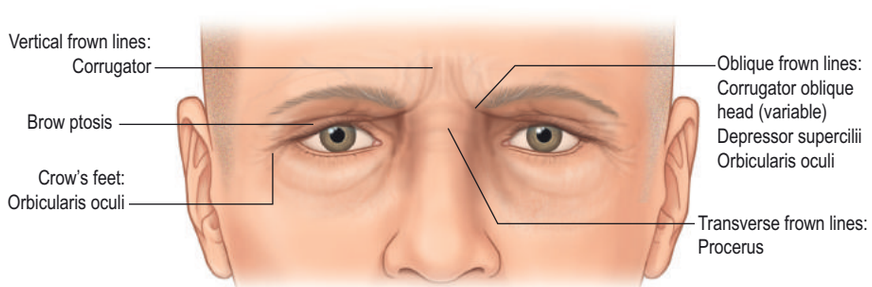
Alternative techniques for forehead rejuvenation include open coronal, lateral temporal brow lift, direct approach through the brow, transpalpebral brow lift with direct excision of the corrugator muscles and neurotoxin injections. During patient selection, the two key problems to address are eyebrow ptosis and frown lines, frontal and glabellar. Brow ptosis is a combination of soft-tissue descent, soft-tissue deflation and loss of lid crease. There is no frontalis muscle lateral to the temporal crest suggesting that 25–30% of the brow tail has no "levator mechanism". p0070

Surgical technique

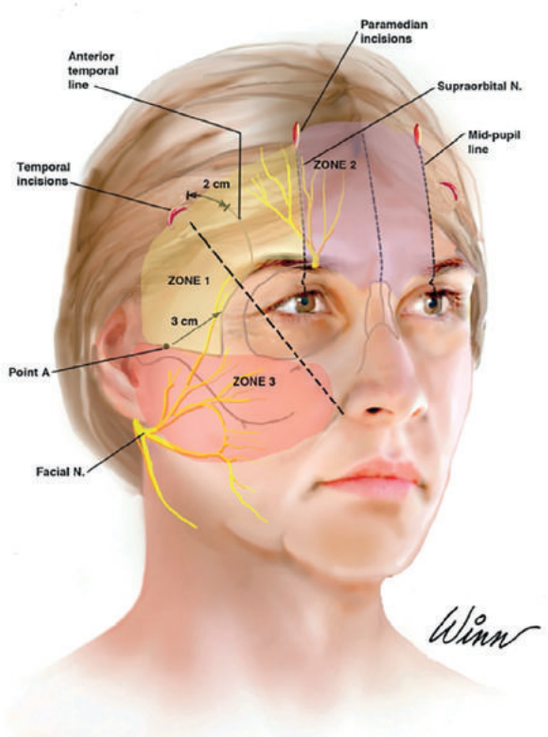
s0030

After adequate informed consent, the patient is marked for surgery in a standing or sitting position. A temporal incision is marked along a vector line from the nasal ala crossing the lateral canthus and continuing to a point approximately 2 cm behind the temporal hairline. A 2-cm curved line is then marked medial to that point in both temporal areas. Paramedian incisions are 1-cm vertical lines posterior to the anterior frontal hairline placed in the axis of mid-pupil line extended superiorly (Fig. 12.6). p0075

The location of the supratrochlear and supraorbital nerves are identified and marked. The location of the deep branch of the supraorbital nerve as it reaches the hairline is also marked approximately 1 cm medial to the temporal crest line. If the patient has brow asymmetry on preoperative evaluation, p0080



f0030 **Figure 12.5** Age-related changes in the brow. These involve brow descent, furrowing, vertical and transverse frown lines, and crow's feet. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia, PA: Saunders Elsevier; 2009.)*



f0035 **Figure 12.6** Preoperative markings. Four-port approach preferred with two temporal and two paramedian incisions. The temporal incisions are placed in a vector from the nasal ala in the direction of the lateral canthus, usually 2 cm behind the temporal hairline. The paramedian incisions are placed in the mid-pupil axis, behind the hairline. *(From Saltz R, Ohana B. Thirteen years of experience with the endoscopic midface lift.* Aesthet Surg J. *2012; 32(8): 927–936; with permission.)*

careful examination should be performed for true brow asymmetry or underlying unilateral upper lid ptosis, which causes ipsilateral elevation of the brow to compensate. In the latter situation, repair of the eyelid ptosis often equalizes brow position, thus avoiding overcorrection of one brow compared to the other.

p0085 Most commonly, the patient is placed under general anesthesia using an endotracheal tube secured to the maxillary incisors with dental floss. Infiltration is achieved using a mixture of 20 mL of 2% lidocaine, 20 mL of 0.25% Marcaine and 1 mL of epinephrine in 160 cc of normal saline. Infiltration is completed with 20-gauge spinal needle in a tumescent fashion. The patient is prepped and draped in a sterile head wrap; an endotracheal tube is also wrapped with sterile plastic drape for easy manipulation inside the sterile field.

p0090 While the use of the endoscopic brow lift has nearly eliminated the need for open coronal brow lifts, there are additional equipment requirements (Fig. 12.7). Equipment should be tested prior to induction of general anesthesia and back-up equipment should be available. The endoscopic equipment on the cart includes a monitor, high-definition camera with ability to record the procedure as well as take photographs, electrocautery base unit and suction. The additional equipment on the field includes a 4–5-mm endoscope, 30° Hopkin rod with an endoscopic sheath camera connector, endoscopic dissectors, endoscopic forceps and rongeurs, and a malleable Durden suction cautery. Many different devices can be used for fixation: a drill for cortical tunnels, a drill for temporary screw fixation, a drill for use of the Endotine devices, or a variety of other fixation methods. The endoscopic cart should be positioned at the foot of the bed with the surgeon positioned at the head of the bed.

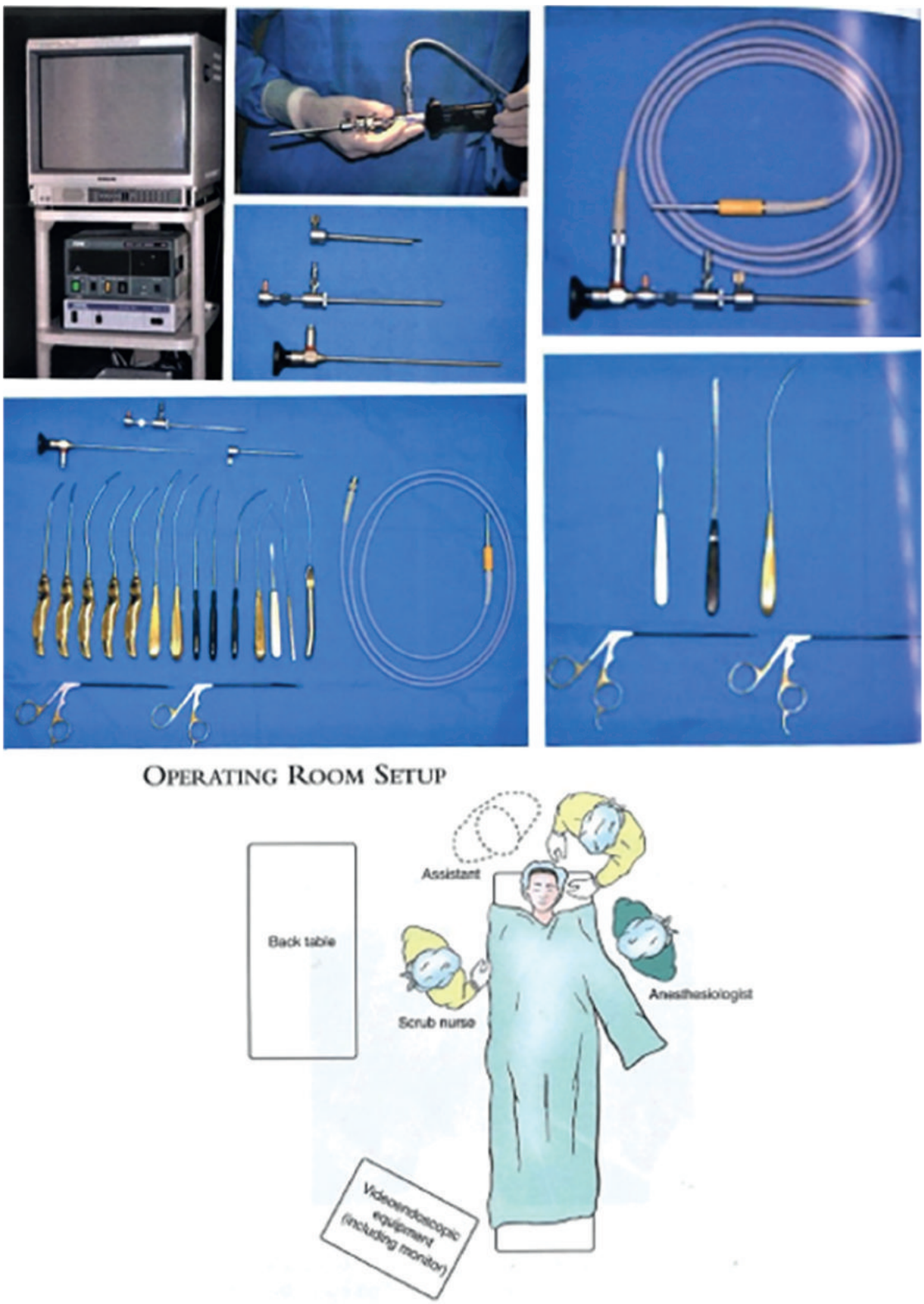
p0095 The procedure begins approximately 20 min after infiltration is completed to obtain maximum vascular constriction. The temporal incision allows visualization and dissection on top of the deep temporal fascia. Blunt dissection is completed in the temporal areas as well as the subperiosteal plane over the frontal bone. Both areas are then communicated after division of soft tissues over the temporal crest (Fig. 12.8). At this point, a 4-mm 30° scope is introduced to continue the dissection. The sentinel veins are identified and preserved (Fig. 12.9). The "fusion ligament" is identified and divided using endoscopic scissors. The dissection continues medially, where the supraorbital nerve is identified and preserved. The periosteal attachments are not transected in the midline, between the corrugator muscles, to minimize medial brow elevation and the so-called "surprised look." At this point, the corrugator fibers are identified and completely excised (Fig. 12.10). Manual palpation and gentle pressure over the skin avoids trauma to the dermis and possible indentations during endoscopic corrugator resection. In cases of very thin skin and possible indentation, immediate placement of fat grafts with suture fixation is recommended. At this point, the surgeon should assess lateral brow mobility to assure both are equally mobile and symmetrical. Temporal fixation is achieved using three interrupted polydioxanone sutures (PDS) from the superficial temporal fascia and galea in a superior lateral vector to the deep temporal fascia. PDS suture is placed using a sharp percutaneous needle. The central portion of the inferior scalp flap may be excised in triangular fashion to prevent redundancy at the lateral brow. Fixation of the paramedian incisions is achieved with the Endotine device (Coapt Systems, Inc., Palo Alto, CA, US) (Fig. 12.11). At this point, still under general anesthesia, the patient is examined in a sitting position for final brow position and brow symmetry. Measurements for comparison include the mid-pupil to top of the mid-brow and the lateral canthus to the tail of the brow. Measurements are recorded and documented in the operative report for future comparison. The incisions are then closed with 4-0 plain gut. The hair is shampooed, and the patient is extubated and taken to the recovery room.

p0100 Endoscopic release of the temporal and zygomatic retaining ligaments allows one to extend dissection inferiorly to the midface in a safe plane expanding the application of endoscopic technique to midface rejuvenation. Also, endoscopically releasing the zygomatic ligaments facilitates the superficial musculo-aponeurotic system (SMAS) open dissection when performing concomitant facelift. This allows SMAS and sub-SMAS elevation with subsequent fixation in a much safer approach and decreases operative time.

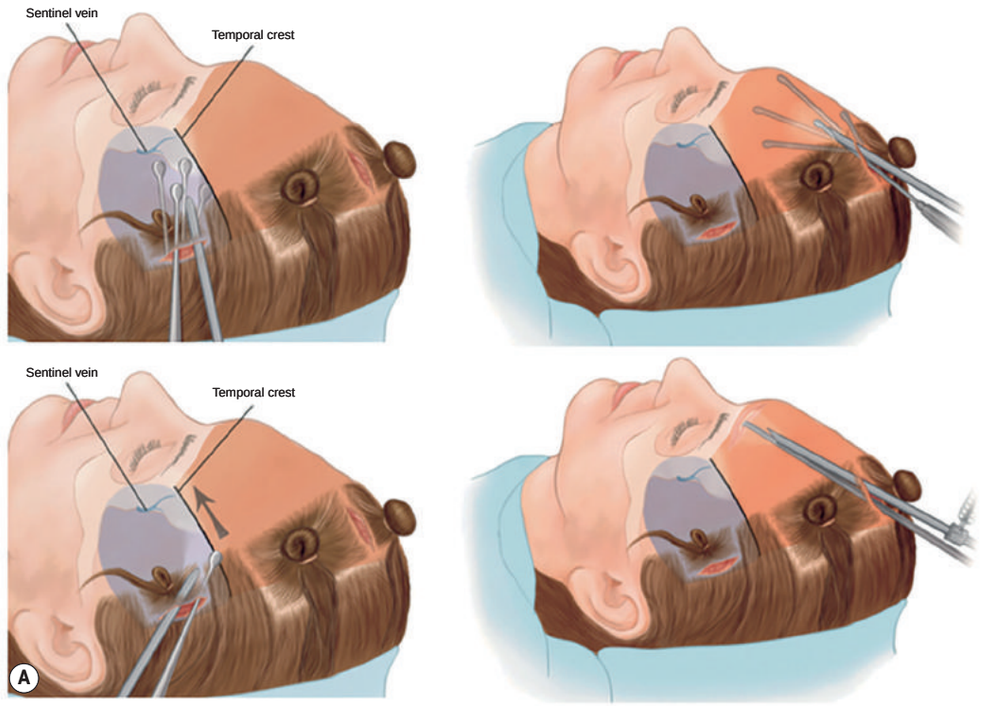
Postoperative care

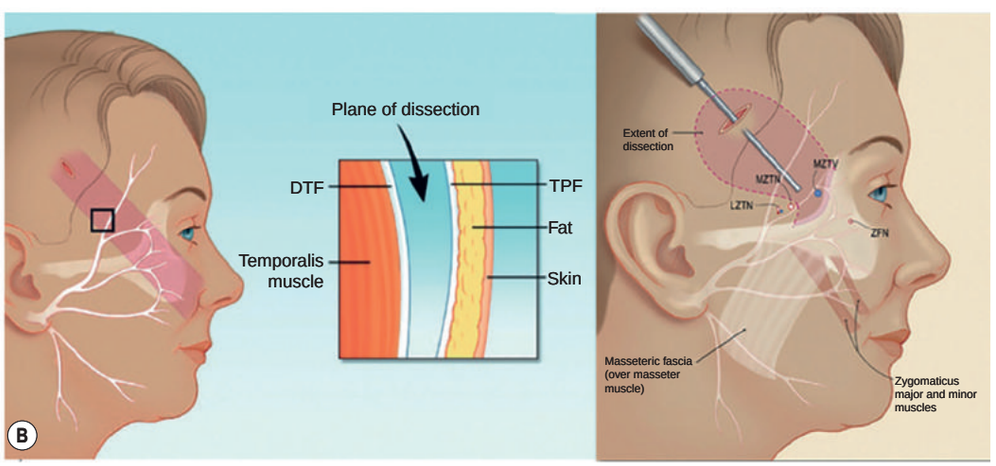
s0035

p0105 The patient should be treated with analgesics for the first 48–72 h with ice compresses to decrease pain and headaches. The patient's head should be kept elevated to decrease venous congestion and improve the lymphatic drainage. Lymphatic massage performed in the first 72 h by a certified lymphatic massage therapist can decrease swelling and bruising, improve patient comfort and expedite recovery.



f0040 **Figure 12.7** Surgical table and equipment. *(From Foad N., et al.* Endoscopic Plastic Surgery. *QMP. New York: Thieme Medical Publishers, Inc.; 2008, with permission.)*





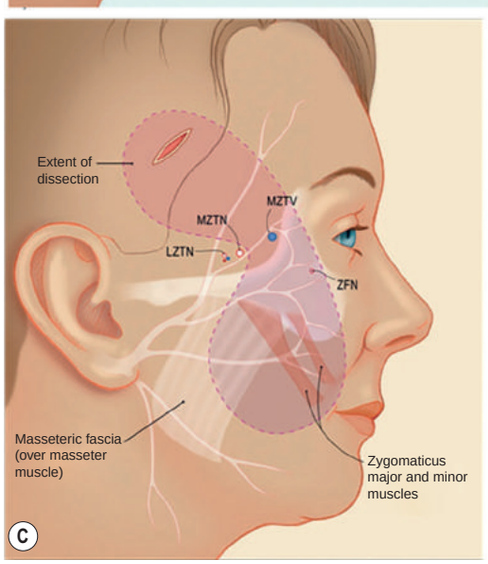


Figure 12.8 Forehead dissection. **(A)** Starts with release of temporal zone using periosteal dissectors on the surface of the deep temporal fascia in the lateral area and on the periosteum in the medial area. After these pockets are completed, the temporal line of fusion is released in a lateral-to-medial direction. This "blind" dissection is kept approximately 1 cm above the supraorbital rim. The index finger of the contralateral hand stays on top of the supraorbital rim to protect the orbit. The 30°-angle 4-mm endoscope is only introduced after the temporal and forehead regions are completely released. **(B, C)** The temporal pocket is developed easily and safely by smooth dissection on top of the deep temporal, above the temporalis muscle and below the superficial temporal fascia, thus protecting the intermediate fat pad and the frontal branch of the facial nerve. *DTF*, Deep temporal fascia; *LZTN*, lateral zygomatic temporal nerve; *MZTN*, medial zygomatic temporal nerve; *TPF*, temporal parietal fascia, also known as superficial temporal fascia; *ZFN*, zygomatic facial nerve. *(From Saltz R, Lolofie A. My evolution with endoscopic brow-lift surgery.* Facial Plast Surg Clin North Am. *2021;29(2):163–178)*

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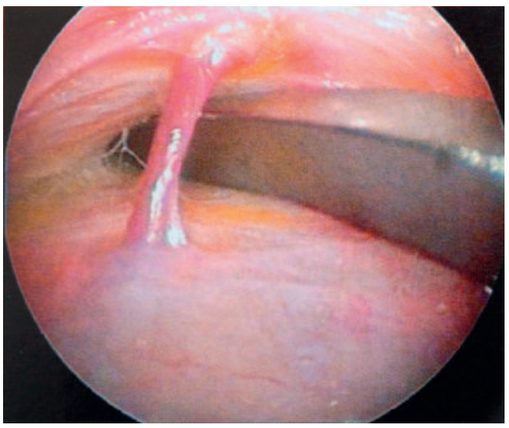


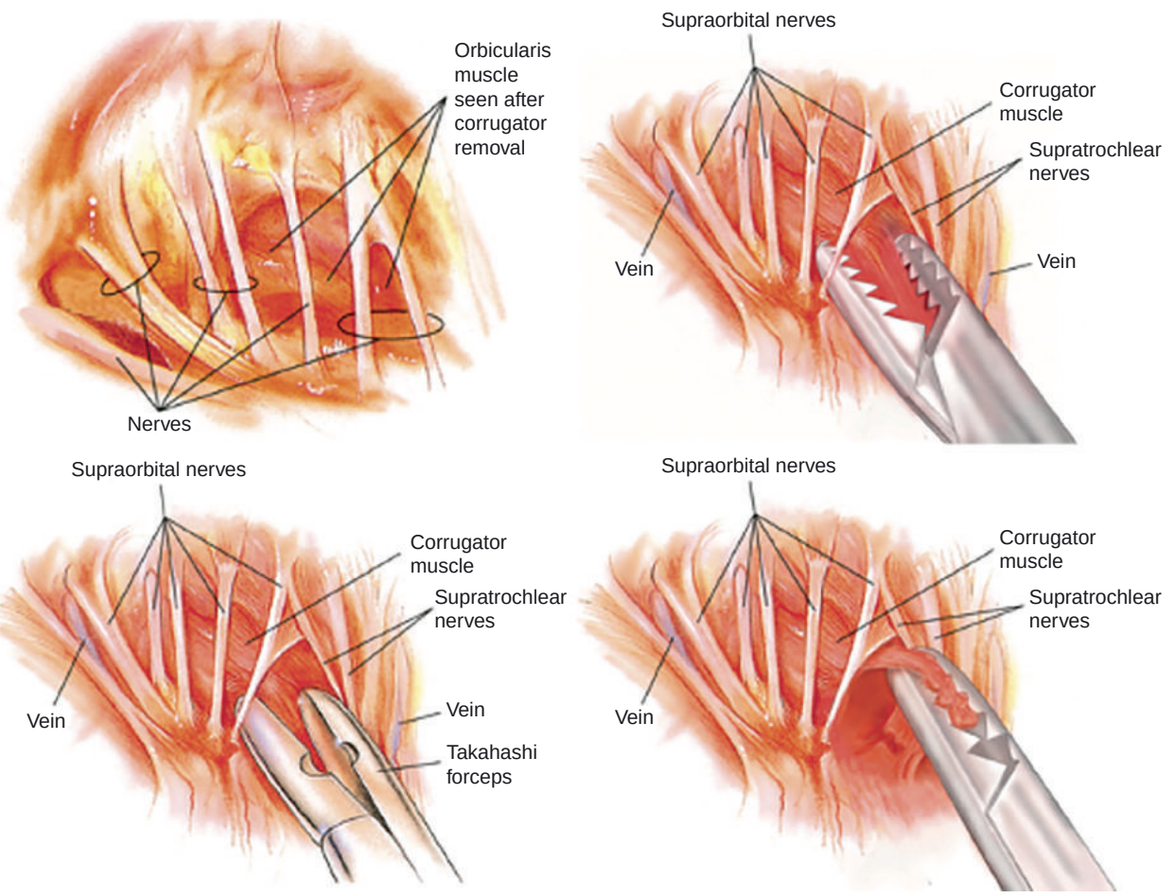
f0050 **Figure 12.9** Sentinel vein. The sentinel vein is encountered during endoscopic dissection. The identification of the sentinel vein identifies a standard landmark for the frontal branch of the facial nerve. Dissection should not proceed beyond this. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M (eds).* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)*

Outcomes, prognosis and complications s0040

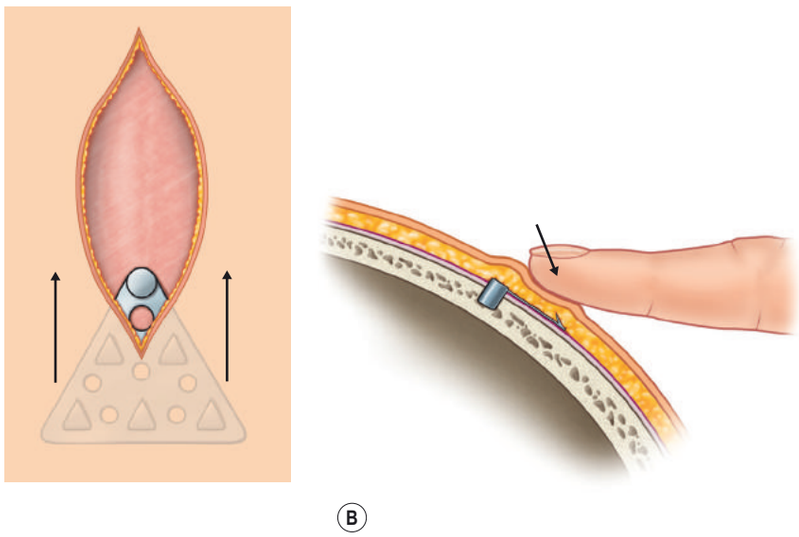
Despite the advantages, the endoscopic approach for forehead rejuvenation and brow lift is not without complication. Relapse has declined over the years due to increased and better use of permanent fixation. p0110

The "surprised look" has been eliminated by preserving a bridge of periosteum in the midline and avoiding fixation at the paramedian incisions in patients that have very mobile medial brows or a hyperactive medial frontalis muscle. Alopecia was eliminated after eliminating percutaneous screw fixation and changing to the completely buried, absorbable Endotine devices. The alopecia was caused by improper pressure in the scalp skin with screw fixation and staple technique. Anecdotal reports have blamed the cortical tunnel technique for fixation as a potential cause of intracranial bleeding during an endoscopic brow lift. p0115

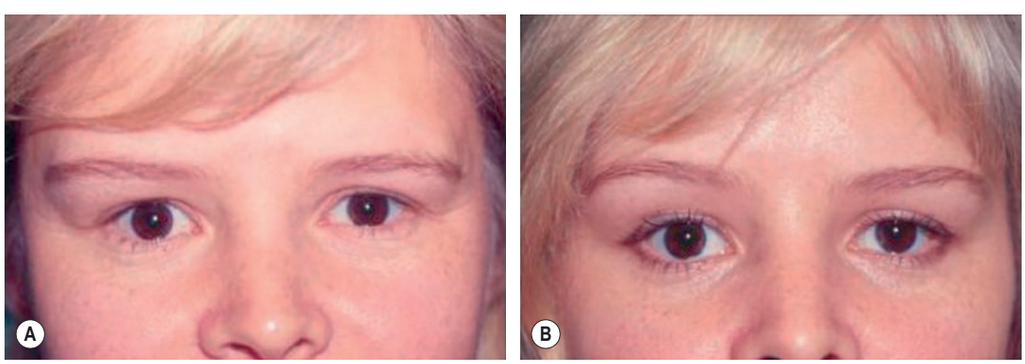
Injury to the supratrochlear and supraorbital nerves causing temporary paresthesia is another potential complication. It can be minimized by appropriate scalp incision placement avoiding p0120



f0055 **Figure 12.10** Corrugator muscle. The corrugator muscles may be resected endoscopically with grasping forceps, taking care not to injure the supraorbital or supratrochlear nerves. *(From Saltz R, Lolofie A. My evolution with endoscopic brow-lift surgery.* Facial Plast Surg Clin North Am. *2021;29(2):163–178)*



f0060 **Figure 12.11** Endotine fixation. **(A)** The Endotine divot hole is drilled through the first layer of calvarial bone and situated at the caudal extent of the incision. The Endotine is snapped into place. **(B)** The scalp can then be repositioned vertically and held in place by fixation tines. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)*



f0065 **Figure 12.12** This patient is shown **(A)** before and **(B)** after endoscopic brow lift, demonstrating an increased brow–lash distance and an aesthetically pleasing arch to the eyebrow. *(Reproduced from Saltz R, Codner M. Endoscopic brow lift. In: Nahai FR, Nahai F, Codner M, eds.* Techniques in Aesthetic Plastic Surgery: Minimally Invasive Facial Rejuvenation. *Philadelphia: Saunders Elsevier; 2009.)*

trauma to the deep branch of the supraorbital nerve as well as gentle tissue manipulation using the endoscope. The subperiosteal dissection retains the vascular blood supply within the forehead flap; therefore, subperiosteal dissection maximizes flap blood supply and minimizes trauma to the deep branch of the supraorbital nerve. Temporary paresthesia and some irregularities of the frontalis muscle are occasionally seen but usually improve within 2–3 weeks. Correction of eyelid ptosis with tarsolevator advancement corrects lid positions as well as brow asymmetry from compensatory brow elevation.

s0045 ## Final considerations

p0125 Endoscopic, minimally invasive surgery does not mean minimal results (Figs. 12.12–12.18). Endoscopic brow lift results and morbidity must match those of direct or "open" approaches. Minimal access is better when combined with a quicker recovery, fewer complications, and sustainable long-term results. Better operative visibility equals increased precision. Endoscopy is now the standard of care in many specialties for these reasons.

p0130 The endoscopic brow lift can be summarized into four easy key surgical steps:

o0010 1. Blunt subperiosteal dissection over deep temporal fascia and frontal bone down to the supraorbital rim.

o0015 2. Meticulous division and spreading of the supraorbital rim periosteum under endoscopic visualization.

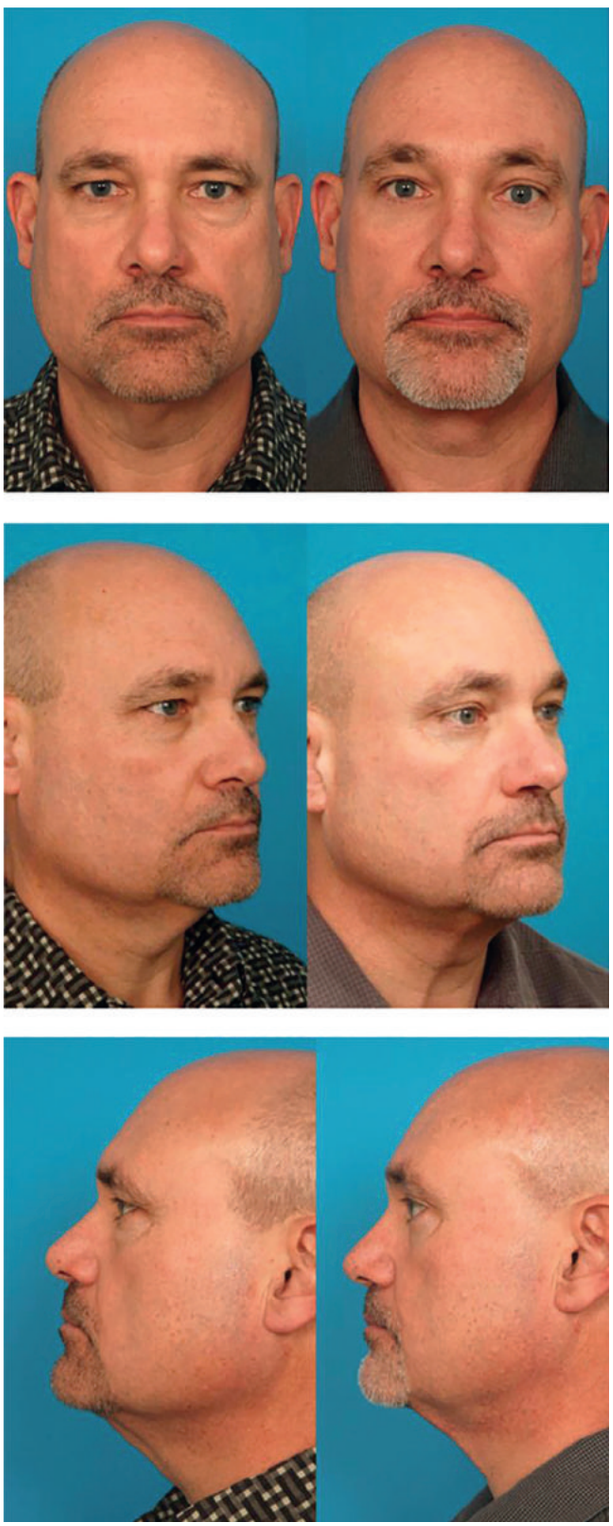
o0020 3. Corrugator muscle resection under endoscopic visualization.

o0025 4. Fixation in the temporal and paramedian wounds.

p0155 Introduction of non-endoscopic procedures for forehead rejuvenation like short scar temporal, transblepharoplasty and anterior hairline approaches are all "blind." They offer operative time similar to an endoscopic approach, however, blindly dissect around potential anomalous variations of the supraorbital nerve and require larger incisions with potential

f0070 **Figure 12.13** Endoscopic brow lift combined with transconjunctival lower blepharoplasty. Ultratines used for paramedian fixation and 3-0 polydioxanone sutures for temporal fixation. Follow-up at 1 year.

f0075 **Figure 12.14** Endoscopic brow lift combined with endoscopic midface lift using two temporal and two paramedian scalp incisions. Fixation of the brow with Ultratines and fixation of the midface with the endomidface device. Follow-up at 1 year.



f0080 **Figure 12.15** Endoscopic brow lift combined with upper and lower blepharoplasty (transconjunctival) and neck liposuction. Endotines used for paramedian fixation; 3-0 polydioxanone sutures for temporal fixation. Follow-up at 2 years.

f0085 **Figure 12.16** Endoscopic brow lift via two temporal and two paramedian scalp incisions combined with facelift and necklift. Endotines used for paramedian fixation; 3-0 polydioxanone sutures for temporal fixation. Follow-up at 1 year.

f0090 **Figure 12.17 (A,B,C)** Endoscopic brow lift via two temporal and two paramedian scalp incisions combined with facelift and necklift. Endotines used for paramedian fixation; 3-0 polydioxanone sutures for temporal fixation. Follow-up at 1 year.

f0095 **Figure 12.18 (A,B,C)** Endoscopic brow lift via two temporal and two paramedian scalp incisions combined with facelift and necklift. Endotines used for paramedian fixation; 3-0 polydioxanone sutures for temporal fixation. Follow-up at 1 year.

damage to the deep branch of supraorbital nerve risking sensory loss and unnecessary scars. The non-endoscopic, blind temporal approach is applicable in selected patients without forehead rhytids; corrugator release is unnecessary and only lateral lift is needed.

p0160 Endoscopic brow lift is a time-tested method of providing highly accurate, precise, safe, long-lasting, and aesthetically focused rejuvenation of the forehead and periocular region. When performed by a properly trained surgeon it is safe and the easiest "gateway" to the midface.

p0165 The endoscopic midface lift technique is minimally invasive and ideal for younger patients with periocular and midface aging that are not candidates for facelift surgery and want long-term results that fillers or fat grafting cannot provide.

p0170 Access the reference list online at **Elsevier eBooks+**

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NON-PRINT ITEM

Abstract

Advances in endoscopic brow lift technique provide a more precise and safer procedure to the aesthetic facial surgeon. Brow shape, symmetry, position, and hyperactivity of the frontalis and corrugator muscles are integral parts of periocular rejuvenation. An upper blepharoplasty should not be indicated or performed for treatment of periocular aging until the brow position and symmetry is fully evaluated and treated.

Modern and safe facial surgeons must incorporate endoscopic technique in their practice – the gold standard treatment for periocular rejuvenation. By extending dissection inferiorly with endoscopic release of the orbital and zygomatic facial retaining ligaments, one can expand the application of safe endoscopic technique to the midface or use as an adjunct to facelift.

Keywords

brow lift; brow rejuvenation; endoscopic brow; midface techniques

Update: Tissue Sealants in Plastic Surgery

Renato Saltz, MD, Salt Lake City, UT, *is a board-certified plastic surgeon and an ASAPS member.*

The technology has advanced rapidly since I reviewed the application of tissue sealants in this column 2 years ago.[1,2] In that short time span, tissue sealants have found new applications in plastic surgery. These include optimal, local hemostasis with sealing of autologous implants and large bleeding surfaces, and the repair of autologous cartilage and bone implants in nasal surgery. Fibrin has been applied in peripheral nerve repair, both as a pathway for regeneration and as a matrix for gap healing in silicon conduits. Clinically, no difference in efficacy has been observed when compared to sutures, although the use of sealants reduces operative time and facilitates nerve sprouting across junction interfaces. A culture of autologous keratinocytes with fibrin sealant to cover burn wounds is another promising application.[3] Moore and Freeman[4] observed the reduction of postoperative serous drainage in their clinical studies of axillary lymph node dissections performed for staging carcinoma of the breast. Their work, as well as many animal models, suggests the possibility that fibrin sealant application may allow for the elimination of surgical drain placement altogether at the time of axillary dissection in modified radical mastectomy or lumpectomy for treatment of early stage breast carcinoma.

Kulbert et al[5] have documented the effectiveness of sealants for the prevention of seromas. Fibrin supports wound healing, seals open tissue channels, and eliminates dead space. Plastic surgeons might soon be able to perform abdominoplasties, face lifts, flap rotations, and tissue undermining and advancement without drains, seroma, or hematoma formation.

Since my last report, two adhesives have been approved by the Food and Drug Administration for clinical use in the United States: Tisseel® VH Kit (Baxter International Inc., Deerfield, IL), a licensed fibrin sealant product, and Dermabond® (Ethicon Inc., Somerville, NJ), a cyanoacrylate topical skin adhesive.

Tisseel® is a two-component fibrin sealant that is vapor heated and contains four substances: sealer protein concentrate (human), fibrinolysis inhibitor solution (bovine), thrombin (human), and calcium chloride. The sealer protein concentrate is a sterile, nonpyrogenic, freeze-dried, vapor-heated powder preparation made from pooled human plasma. The sealer protein and the thrombin solution are combined (by delivering with a dual inject syringe) to form the fibrin sealant. In the United States Tisseel® is only indicated for use as an adjunct to hemostasis in operations involving cardiopulmonary bypass and treatment of splenic injuries resulting from blunt or penetrating trauma. It has also been shown to be an effective sealant in the closure of colostomies. Studies have demonstrated there was no transmission of HIV or hepatitis.[6]

Dermabond® topical skin adhesive (octyl-2-cyanoacrylate) is a sterile, liquid skin adhesive that holds wound edges together. The film usually remains in place for 5 to 10 days, then naturally sloughs. Cyanoacrylates have been used for skin closure for many years. However, they failed to gain widespread popularity because of their suboptimal handling, variable outcome, and tissue toxicity. Octyl-2-cyanoacrylate is formulated to correct those deficiencies. It causes less inflammation with an increased three-dimensional breaking strength, is easier to use, and flexes with the skin, remaining adherent for longer periods of time. Toriumi et al,[7] in a prospective randomized controlled clinical trial of 111 patients, observed statistically significant improved cosmetic outcome at 1 year when surgical wounds were approximated with Dermabond® as compared with sutures. There were no differences in complications among the two groups. The use of Dermabond® significantly decreased the time of treatment for wound closure and eliminated the need for postoperative suture removal. The authors found a high level of satisfaction among patients treated with the skin adhesive as they did not experience the anxiety and discomfort often associated with suture removal.[7-9]

As predicted 2 years ago, American surgeons now have safe, effective and affordable "tissue glues" available for commercial use (Dermabond® costs $24.95 per vial). Other surgical sealants may soon be available in this market as innovation continues. ■

Dr. Saltz is a member of the Ethicon, Inc. Plastic Surgery Advisory Panel.

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Endoscopic Temporal-Incision Only Midface Lift Is Enhanced By Endotine Technique

The Endotine midface technique, through an endoscopic temporal-incision only approach, is the author's preferred method of malar fat pad suspension and fixation. The bioabsorbable Endotine device avoids an intraoral incision, eliminates sutures, offers multipoint fixation, and the leash fixation mechanism provides fast and simple adjustability for optimal control of midface elevation and volume. (*Aesthetic Surg J* 2005;25:80-83.)

There are many different techniques that have been introduced for treating the aging midface. Paul,[1] Hester,[2] Ramirez,[3] and others have clearly defined the anatomic structures and findings common to an aging midface and have offered different treatment options.

Stimulated by the work of these pioneers, I have been using their approaches over the past few years. A significant change in my technique occurred, however, when I introduced direct percutaneous needle fixation into my practice. It was then that I changed my technique to an endoscopic temporal-incision approach.[4]

Surgical Technique

My technique involves careful preoperative evaluation and planning, including detailed assessment of midface position, shape, and volume. Photographs of the patient at a younger age are also useful.

First, make preoperative markings to outline the anatomical structures for endoscopic dissection and the vectors of suspension. The entry point at the temporal region should be about 2 cm behind the hairline. To perform a simultaneous browlift, or to further facilitate endoscopic dissection, paramedian coronal incisions can be added. Perform the dissection laterally above the deep temporal fascia and extend it down along the lateral orbital rim into the malar region in a subperiosteal plane. For the treatment of the midface, continue dissection medially and laterally on zones 1, 3, 4, 5, and 6 (Figure 1). Visualize and preserve the inferior orbital nerve.

Identify and divide the masseter fibers attached to the malar bone. This simple maneuver will facilitate easier suspension and will also prevent early relapse of the midface elevation. The inferior border of the dissection is the superior gingival sulcus and is the point at which you may perform complete release of the periosteum. Following these maneuvers, you can complete direct percutaneous needle fixation (Figure 2).

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The endoscopic temporal-incision technique permits precise positioning and fixation of soft tissues with predictable outcomes. The subperiosteal dissection provides adequate blood supply to the skin flaps and allows the simultaneous use of skin resurfacing modalities such as lasers and chemical peels. The disadvantages of this technique are that it relies on suture suspension only, may result in minor asymmetry because of different vectors for fixation, and involves a long learning curve.

Since October 2003, I have adopted the Endotine midface device (Coapt Systems, Palo Alto, CA) as my preferred method of suspension and fixation for malar fat pad elevation. The surgical technique for dissection is the same as previously described. The deployment system protects the implant during insertion, and deployment is achieved with a simple trigger release to engage tines to soft tissue (Figure 3). Digital pressure engages the tines (Figure 4). Once the soft tissue is engaged, the insertion tool is removed through the temporal incision (Figure 5). Tension is applied to the anchoring leash to achieve the desired elevation. The leash is then sutured to the temporal fascia and the excess leash is trimmed (Figure 6).

Conclusion

This easy, step-by-step midface suspension-fixation device enhances soft tissue fixation, provides simple adjustability for optimal elevation and projection, and maintains mechanical fixation until biologic fixation is adequate. The 5 tines provide multiple points of contact for secure soft tissue fixation. The elevation forces are evenly distributed over a wide area, eliminating skin irregularities. Insertion and deployment are easily accom-

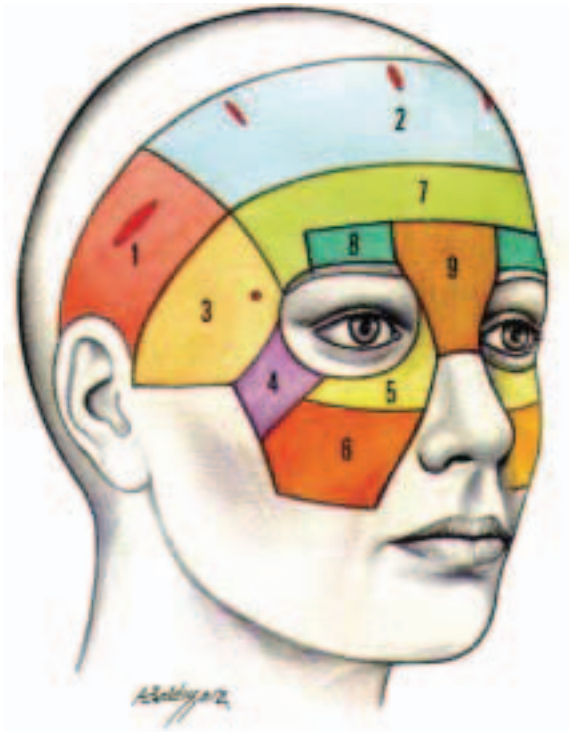

Figure 1. *Endoscopic facial zones in a subperiosteal plane of dissection.*[5]

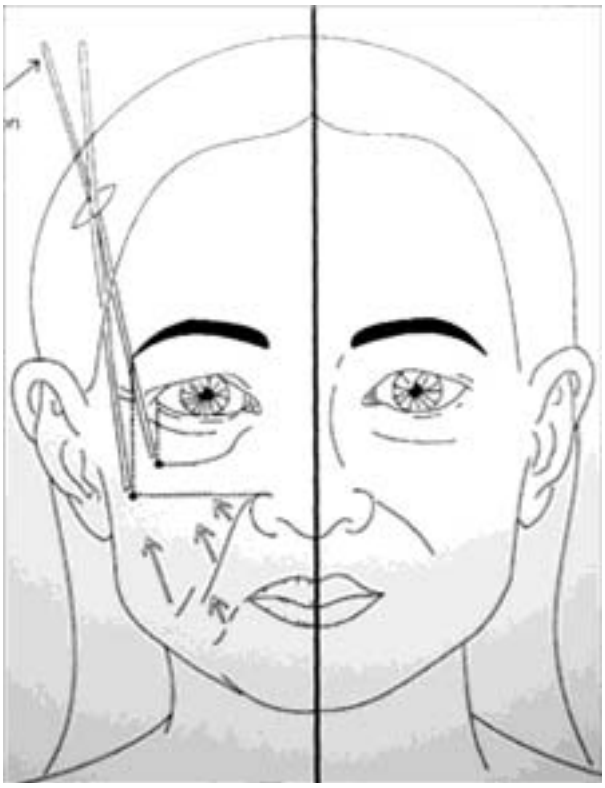

Figure 2. *Markings for midface suspension using the direct needle fixation technique. (Images 2 through 6 courtesy of Coapt Systems.)*

Figure 3. *Insertion of the midface device through a temporal incision. The midface device protects the implant during insertion and has a trigger release to engage tine to soft tissue.*

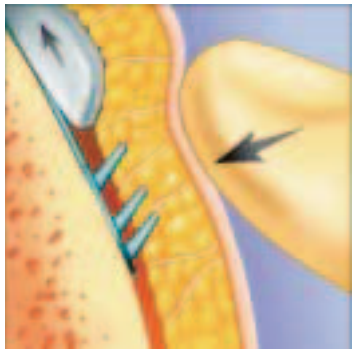

Figure 4. *Once in position, the trigger mechanism retracts the protective cover from the fixation platform. Digital pressure engages the tines.*

Figure 5. *Once the soft tissue is engaged, the insertion tool is removed through the temporal incision.*

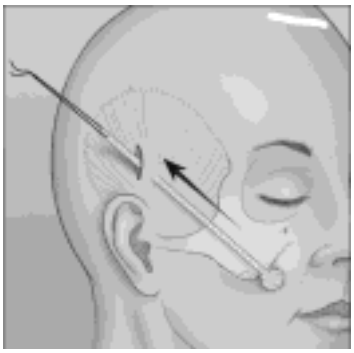

Figure 6. *Tension is applied to the leash to achieve the desired elevation. The leash is then sutured to the temporal fascia. Excess leash is then trimmed.*

Figure 7. A, C, E, *Preoperative views of a 52-year-old woman.* **B, D, F,** *Postoperative views 6 months after endoscopic brow lift and midface lift with a temporal incision only.*

Figure 8. A, C, E, *Preoperative views of a 40-year-old woman.* **B, D, F,** *Postoperative views 1 year after endoscopic brow lift and midface lift with a temporal incision only.*

plished through the temporal incision. Implant palpability is minimal, and reabsorption starts at 6 months.

Although follow-up has been only 1 year, I believe that the Endotine midface technique through an endoscopic temporal-incision approach offers many advantages: (1) it avoids an intraoral incision; (2) it eliminates sutures; (3) the deployment is simple, secure, and offers multipoint fixation; (4) the device is bioabsorbable; and (5) the leash fixation mechanism provides fast and simple adjustability for optimal control of the elevation and volume of the midface.

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My Evolution with Endoscopic Brow-Lift Surgery

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KEYWORDS

• Facial rejuvenation • Endoscopic facial rejuvenation • Endoscopic brow lift

KEY POINTS

INTRODUCTION

1–19

Fig. 1

CONTENT

Indications

Fig. 2

Patient Selection

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Fig. 3

Fig. 1.

Fig. 4

Fig. 5

Preoperative Preparation

Anatomy (Brief Review)

Fig. 2.

Fig. 3.

possible elevation of the anterior hairline; medial brow elevation; position, shape, and elevation of the lateral brow; softening and spreading of the intermedial brow space after corrugator resection (**Fig. 6**

Equipment

Fig. 4.

Fig. 7

Fig. 5.

https://doi.org/10.1097/00006534-199606000-00001

Fig. 6.

Position/Markings

Fig. 7.

1 cm medial to the temporal crest line. In addition, the desired vector of brow elevation is also mapped (**Fig. 8** [20]

Fig. 8.

https://doi.org/10.1177/1090820X12462714

Anesthesia

Surgical Technique

Fig. 13

Fig. 9

Fig. 10

Postoperative Care

Fig. 11

Fig. 12

Pitfalls and How to Correct

Fig. 9.

my practice after I abandoned percutaneous screw fixation and changed to the completely buried Endotine device. The alopecia was caused by improper local pressure in the surrounding scalp skin with the screw fixation technique. Anecdotal reports have blamed the cortical tunnel technique for fixation as the cause of an intracranial bleeding during an endoscopic brow-lift procedure. Injury to the supratrochlear and supraorbital nerves causing temporary paresthesia is another potential complication. It can be minimized by adequate scalp incision placement, avoiding trauma to the deep branch of the supraorbital nerve as well as gentle tissue manipulation and careful soft tissue retraction using the endoscope. The subperiosteal dissection plane retains the vascular blood supply within the forehead flap; therefore, subperiosteal dissection maximizes flap blood supply and minimizes trauma to the deep branch of supraorbital nerve. Temporary

Fig. 10.

Blind Brow Lifts

Fig. 11.

Fig. 14

Fig. 12.

Pearls

Fig. 13.

Fig. 14.

periosteum, (3) corrugator removal, and (4) forehead and temporal fixation.

- Keeping the dissector close to the deep temporal fascia is much safer and avoids any trauma to the frontal branch of the facial nerve.
- Knowledge of the anatomy of motor and sensory nerves and careful dissection during brow-lift surgery are essential to prevent complications.
- Keeping the assistant's fingers palpating the skin while avulsing the corrugators may prevent overresection of subcutaneous fat with resulting depression.
- Avoid dividing periosteum from side to side. Preserving the periosteum intact at midline will prevent elevation of the medial brow and the "surprised look."
- In most cases, in women, the lateral brow needs to be elevated higher than the central and medial brow. In men, the elevation should be equal to avoid feminization of the male brow.
- Early failure is caused by inadequate release of periosteal septa and adhesions. Late failure is caused by inadequate fixation.

SUMMARY

Figs. 15-19 [20-22]

Fig. 16.

Fig. 15.

Fig. 18.

Fig. 17.

Fig. 19.

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CAPÍTULO 9

Rejuvenescimento do Terço Superior da Face

Renato Saltz
Alyssa Lolofie
Omid Adibnazari

INDICAÇÕES

A estética das sobrancelhas não pode ser generalizada em virtude de uma mudança de seu formato e posição ideais. Embora a sobrancelha deva ser avaliada com base no sexo, etnia, formato da órbita, envelhecimento e proporções faciais globais, o principal fator a ser considerado é a relação entre a pálpebra visível e a prega palpebral. Os melhores candidatos para o rejuvenescimento do terço superior da face são pacientes com ptose de sobrancelha, assimetria, *hooding* temporal e rugas da testa. Normalmente, eles também apresentam um terço superior da face curto e plano e linha de implantação dos cabelos não recuada.

PREPARO PRÉ-OPERATÓRIO

O exame do paciente inclui a avaliação de ambas as posições – medial e lateral – das sobrancelhas, a relação entre a sobrancelha e a pálpebra superior, as linhas frontais e glabelares, o formato e a altura do terço superior da face e a linha de implantação dos cabelos. Para avaliação da força da ação muscular, do movimento e da profundidade das pregas de tecidos moles, o paciente deve ser solicitado a franzir e elevar as sobrancelhas. As sobrancelhas também devem ser avaliadas quanto a espessura, formato e posição. Na consulta pré-operatória, o médico deve informar o número de incisões e o tipo de fixações. Com base na avaliação do paciente, a cirurgia pode ser planejada. A inclusão do paciente é importante, uma vez que os *lifts* de sobrancelhas são individualizados.

A técnica endoscópica é baseada na utilização de tecnologia moderna, na qual a tradicional coordenação cirúrgica mão-olho é feita mediante um sistema de videoendoscopia. Um treinamento extenso adicional é necessário não só para o cirurgião, mas para todos os médicos e enfermeiros envolvidos no caso cirúrgico.* Em geral, o equipamento – endoscópio, câmeras e monitores – é padronizado nos centros onde são realizadas cirurgias estéticas. Tornou-se importante testar cada sistema, inspecionar cada instrumento e verificar se há um sistema de *backup* como uma salvaguarda. O cirurgião deve ter conhecimento dos princípios que se estendem desde o treinamento até os equipamentos mecânicos e as habilidades técnicas.

*Nota dos autores: o principiante deve levar seu assistente para cursos/*workshops* com cadáveres para aprenderem juntos.

POSIÇÃO/MARCAÇÕES

Na preparação para o procedimento, o paciente é posicionado ereto para a marcação, de modo a se utilizar a posição natural das sobrancelhas. Para incisão temporal, marca-se uma linha do vetor lateral superior a partir da asa do nariz, cruzando o canto lateral e continuando até um ponto localizado aproximadamente 2cm atrás da linha de implantação temporal dos cabelos. Uma linha curva de 2cm é então marcada medialmente a esse ponto em ambas as áreas temporais. Para incisões medianas, traça-se uma linha reta a partir do meio da pupila, superiormente à linha de implantação frontal anterior dos cabelos. Uma linha vertical de 1cm posterior à linha de implantação dos cabelos é marcada nessas áreas para as incisões medianas.

A localização dos nervos supratroclear e supraorbital também é identificada e marcada. A localização do ramo profundo do nervo supraorbital, quando ele atinge a linha de implantação dos cabelos, também é marcada cerca de 1cm medial à linha de crista temporal.

As marcações são feitas em ambos os lados da face, definindo a crista temporal, as veias sentinelas e a posição presumida dos ramos dos nervos supratroclear e supraorbital. Quando a veia sentinela não pode ser encontrada com o paciente na posição ereta, ele é colocado em decúbito dorsal. Solicita-se ao paciente para cerrar os dentes e, por meio de palpação, podem ser marcados o músculo temporal e a crista temporal. As marcações representando as incisões são feitas de 1 a 2cm além da linha de implantação temporal dos cabelos, verificando para que as

incisões sejam realizadas sobre o músculo temporal. As marcações da incisão lateral devem ser paralelas à sobrancelha, enquanto a incisão paramediana será radial, ao longo da linha média da face, fronte e crânio.

Os dois vetores do *lift* das sobrancelhas são marcados. Eles são determinados pela elevação das sobrancelhas manualmente até a posição estética escolhida. O vetor lateral inclui a cauda da sobrancelha, enquanto o vetor medial inclui o arco da sobrancelha; ambos se valem do canto lateral, da boca e da asa do nariz para determinação do posicionamento. Antes da infiltração, o cabelo é limpo e trançado ou grampeado em cada lado dos sítios de incisão escolhidos. Isso mantém o cabelo bem longe dos sítios de incisão.

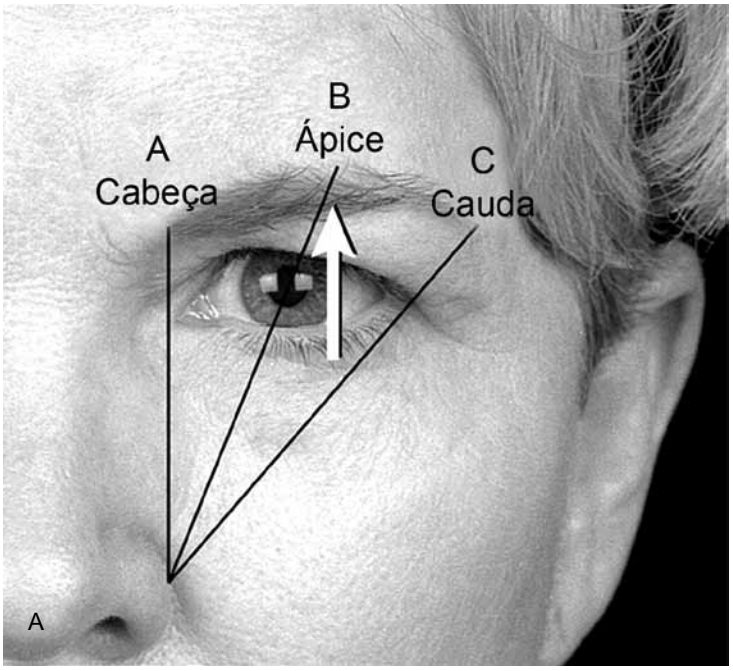

Figura 9.1 ▸ **A** Estética da sobrancelha. **B** Pacientes ideais. **B1.** Mulher jovem com músculo frontal hiperativo. **B2.** Homem jovem com ptose e assimetria da sombracelha. **B3.** Mulher de 42 de idade com *hooding* temporal e ptose da sombracelha.

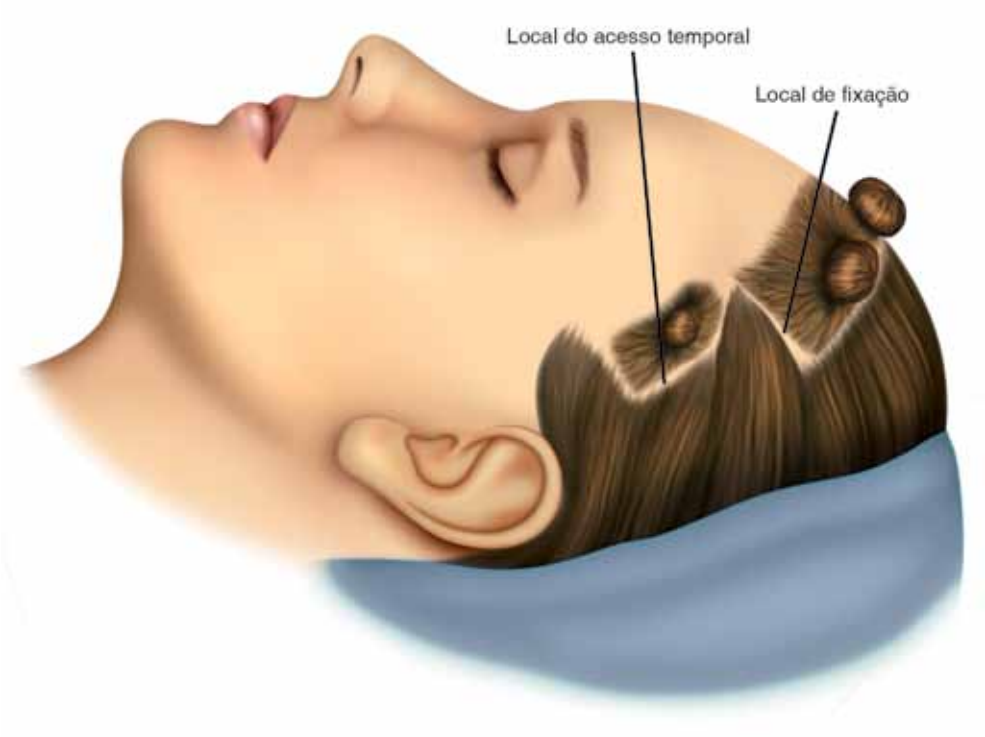

Figura 9.2 ▸ Marcações da incisão e sítios de fixação.

ANESTESIA

A conduta mais comum para o paciente consiste na anestesia geral com cânula endotraqueal, que é fixada com fio dental aos dentes. Infiltra-se o sítio da incisão usando uma agulha espinhal de calibre 20, de modo tumescente, com uma solução de lidocaína a 2%, 20mL de marcaína a 0,25% e 1mL de adrenalina em 140mL de soro fisiológico. O paciente deve, então, ser preparado e coberto seguindo a técnica asséptica padronizada.

TÉCNICA CIRÚRGICA

O *lift* de sobrancelhas é dividido em quatro etapas fundamentais:

1. Dissecção subperiosteal romba sobre o osso frontal, descendo até o rebordo supraorbital.
2. Divisão meticulosa e descolamento do periósteo do rebordo supraorbital sob visualização endoscópica.
3. Ressecção muscular sob visualização endoscópica.
4. Fixação nas feridas temporal e paramediana.

DISSECÇÃO

O procedimento pode começar depois de 20 minutos da infiltração para aumentar a constrição vascular. É feita uma incisão desde o couro cabeludo até a fáscia temporal, o que permite que a visualização e a dissecção permaneçam no topo da fáscia temporal profunda. A dissecção é realizada até o ligamento de fusão, preservando-se intactas as veias sentinelas, quando possível. A dissecção é, então, orientada medialmente, dividindo-se a crista temporal com um elevador de periósteo e continuando a dissecação de um plano subperiosteal. Nesse ponto, a dissecção continua a partir das incisões paramedianas, comunicando ambos os bolsos (fáscia temporal profunda com o plano subperiosteal). Um endoscópio de 4mm a 30 graus é mais uma vez calibrado com o foco adequado – *white out* – sistema de irrigação e inserido no campo cirúrgico. As luzes do ambiente são diminuídas para melhorar a visualização da tela.

Com o endoscópio na incisão temporal, as veias sentinelas são encontradas e preservadas, quando possível, enquanto as aderências circunvizinhas são removidas. Em seguida, a face caudal da crista temporal do "ligamento de fusão" (junção da fáscia temporal profunda com o periósteo) é identificada e dividida com a tesoura endoscópica. O periósteo do rebordo supraorbital é dividido na porção lateral para a medial, identificando e preservando o feixe neurovascular supraorbital. O periósteo é, então, dividido de cada rebordo orbital lateral, o que serve para permitir a maior elevação lateral das sobrancelhas e para fornecer acesso à musculatura glabelar. Uma ilha de periósteo é preservada na linha média

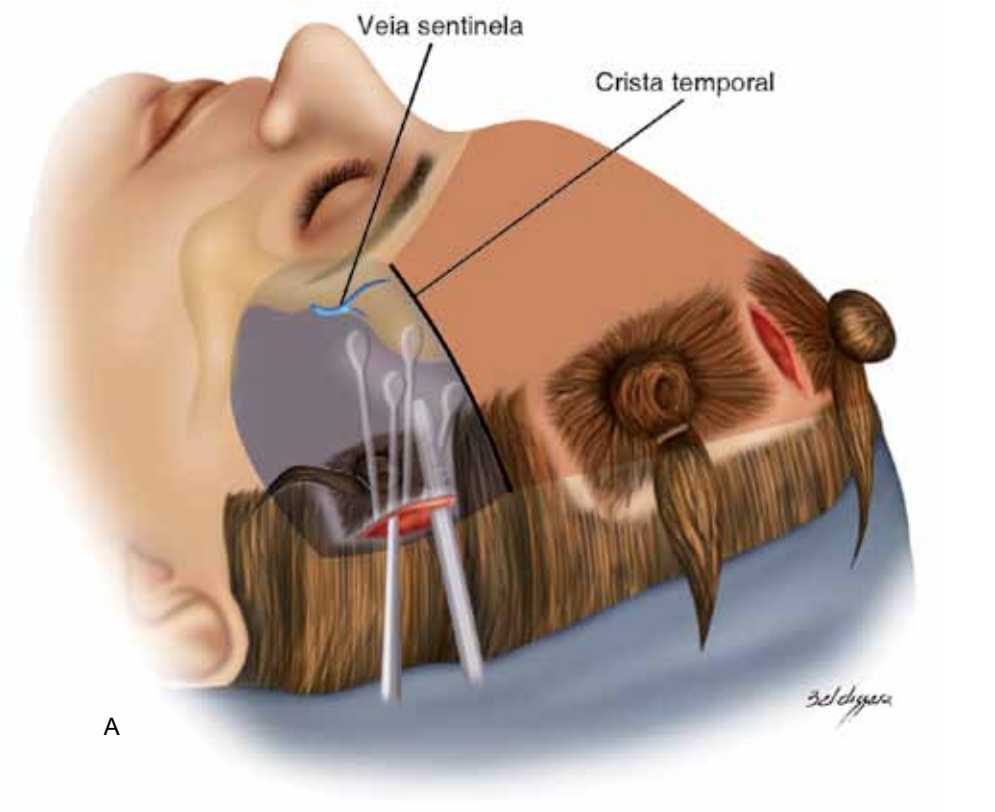

Figura 9.3 ▸ Sequência temporal e de dissecção subperiosteal. **A** Dissecção sobre a fáscia temporal profunda. **B** Dissecção através da crista entrando no plano subperiosteal (*continua*)

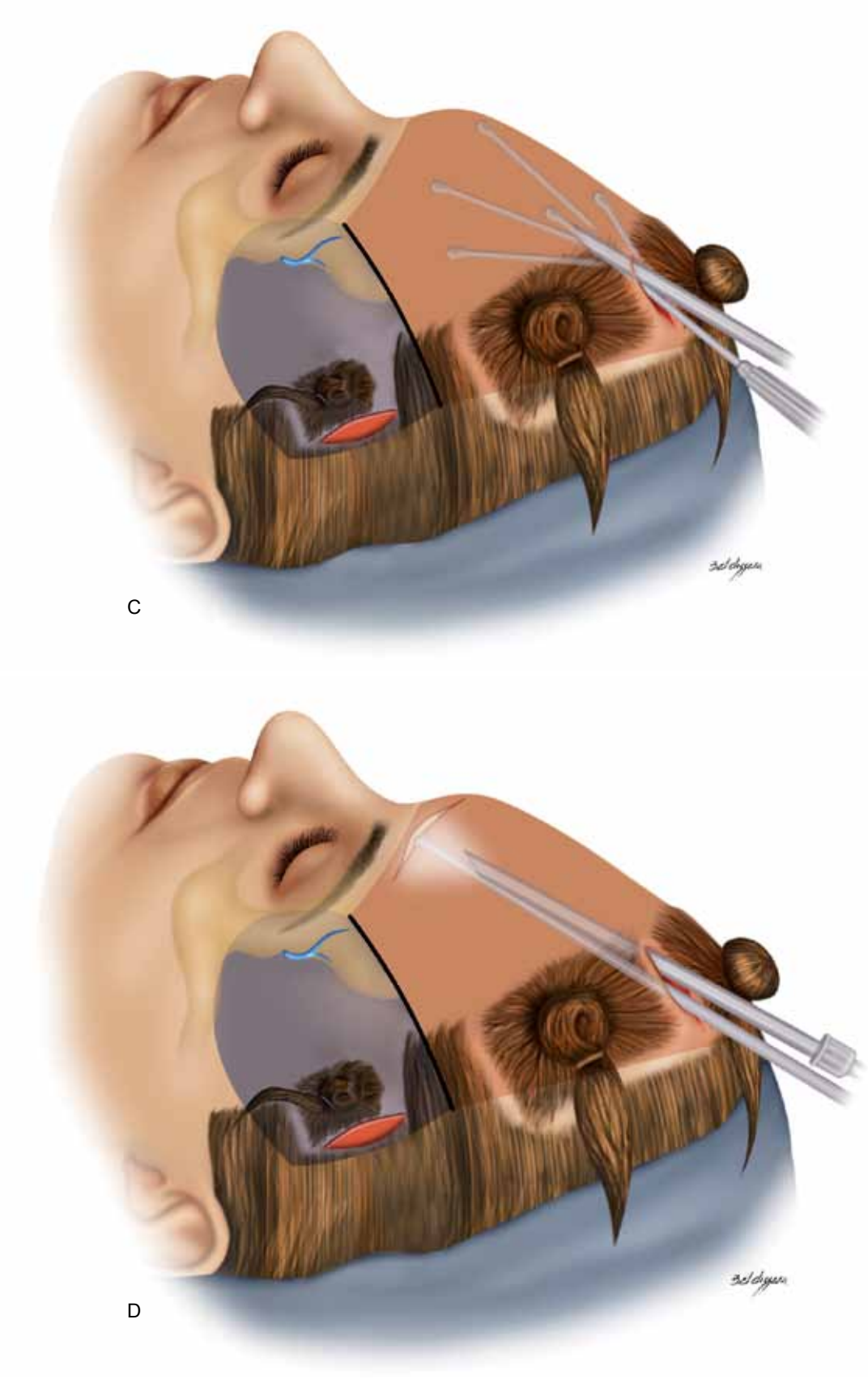

Figura 9.3 ▸ (*Continuação*). **C** Dissecção subperiosteal sobre o osso frontal. **D** Visualização endoscópica com um endoscópio de 4mm e ângulo de 30 graus.

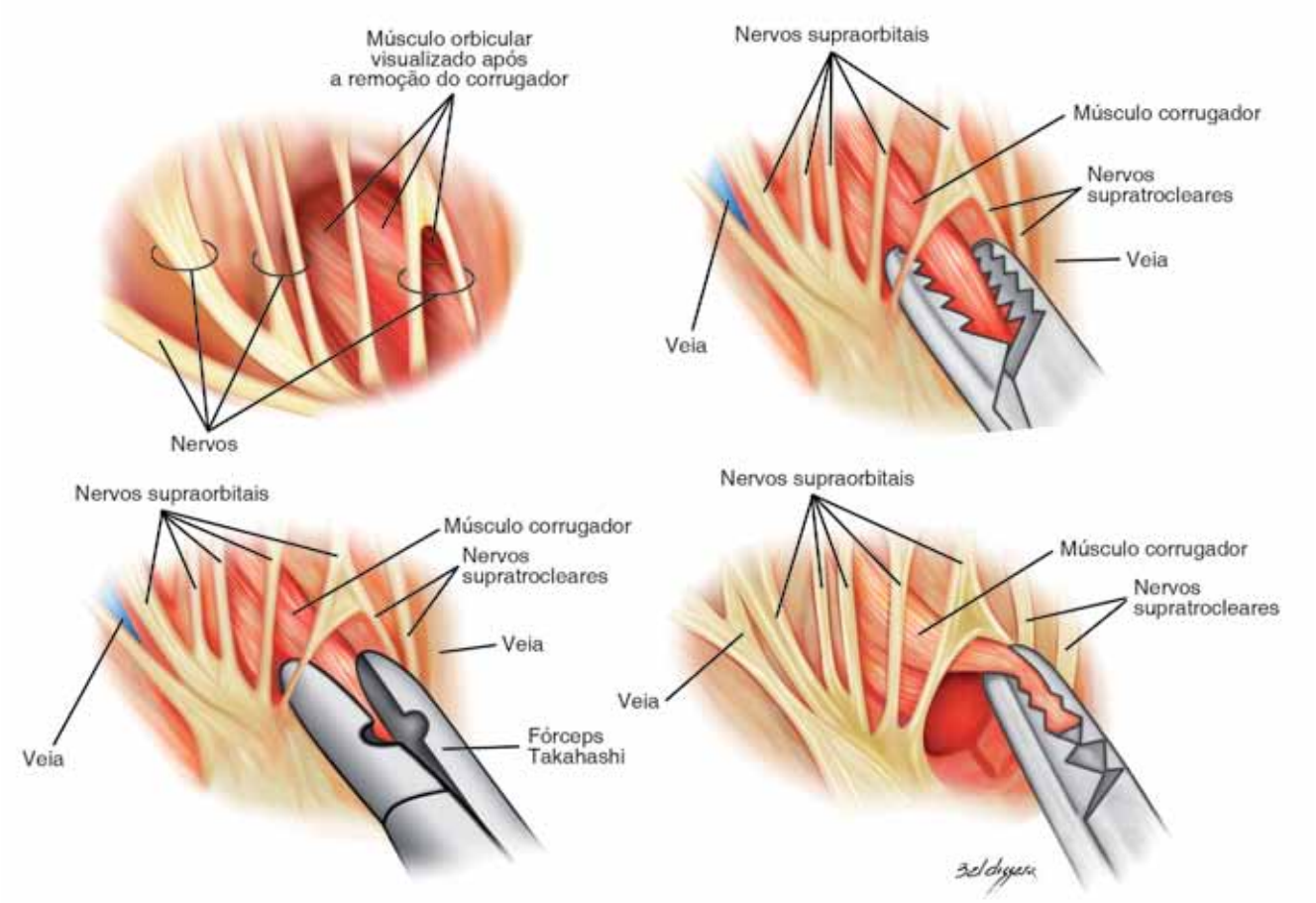

Figura 9.5 ▸ Ressecção dos corrugadores.

para evitar a elevação da porção mais medial da sobrancelha. Os músculos corrugadores são identificados e extirpados/avulsionados usando *graspers* endoscópicos. O assistente "empurra" a pele externa para ajudar na ressecção dos corrugadores e permitir que o cirurgião visualize a derme e evite a super-ressecção, causando uma depressão externa. No caso de uma depressão ser identificada durante o procedimento, é recomendado o imediato enxerto de gordura. A conclusão do procedimento pode ser testada movendo-se a sobrancelha para cima e para baixo, a qual deve ser móvel nesse ponto.

FIXAÇÃO

As fixações temporais são realizadas usando-se três suturas interrompidas ligando a fáscia temporal superficial e a fáscia temporal profunda com suturas com mersylene 3-0. O excesso de pele é removido e a ferida é fechada com categute simples 4-0. A fixação paramediana é realizada com o dispositivo Endotine. O dispositivo Endotine é fixado firmemente na tábua externa com um orifício medido com o auxílio de uma broca. O dispositivo é firmemente inserido, seguido de uma pressão digital para manter o periósteo e a gálea no lugar. O paciente é, então, avaliado na posição sentada, ainda sob anestesia geral. As medidas incluem a pupila-centro da sobrancelha e canto lateral-cauda da sobrancelha. O cabelo é lavado e o paciente é levado para a sala de recuperação. Nenhum curativo é aplicado.

ARMADILHAS E SUA CORREÇÃO

Apesar de suas vantagens, a via endoscópica para o rejuvenescimento do terço superior da face e para o *lift* de sobrancelhas não é isenta de complicações. A taxa de recorrência tem diminuído ao longo dos anos em função do uso crescente da fixação permanente. O olhar de "surpresa" foi eliminado pela preservação de uma ponte de periósteo na linha média e evitando-se a fixação nas incisões paramedianas em pacientes que têm os segmentos mediais das sobrancelhas muito móveis ou um músculo frontal medial hiperativo. A alopecia foi eliminada da prática dos autores

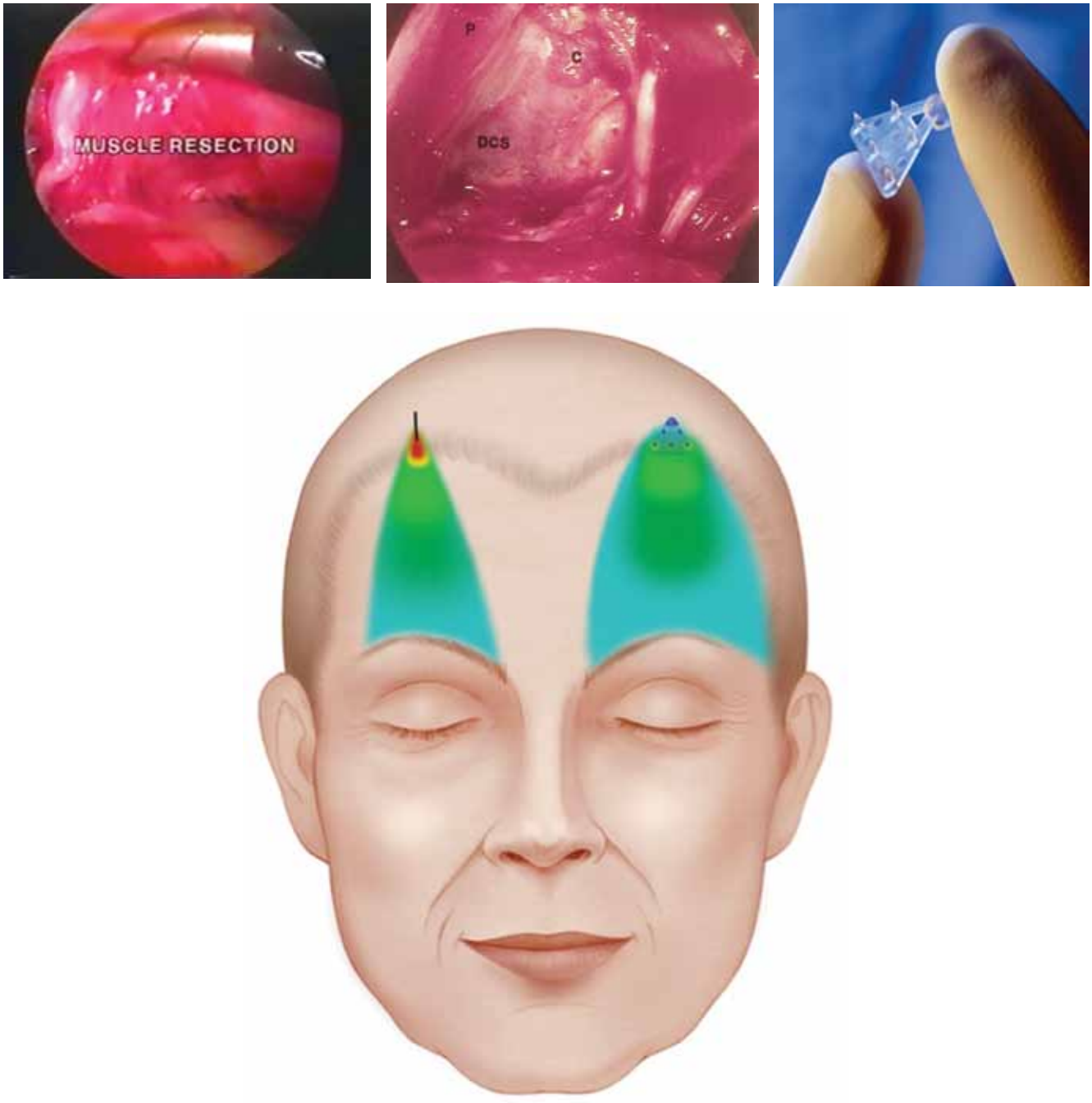

Figura 9.5 ▸ Fixação das sobrancelhas com o dispositivo Endotine.

depois de abandonada a fixação percutânea de parafuso e de terem passado ao uso do dispositivo Endotine completamente encoberto. A alopecia foi causada pela pressão local imprópria na pele do couro cabeludo circunvizinho com a técnica de fixação do parafuso. Relatos anedóticos referiam-se à técnica de tunelamento cortical como causa de uma hemorragia intracraniana durante *lift* das sobrancelhas por via endoscópica. A lesão dos nervos supraorbital e supratroclear, causando parestesias temporárias, é outra complicação possível. Ela pode ser minimizada pelo posicionamento correto da incisão no couro cabeludo, evitando o traumatismo do ramo profundo do nervo supraorbital, bem como a manipulação delicada dos tecidos e a retração cuidadosa dos tecidos moles com o endoscópio. O plano de dissecção subperiosteal mantém o suprimento sanguíneo vascular dentro do retalho da fronte. Por isso, maximiza o suprimento sanguíneo do retalho e minimiza o traumatismo do ramo profundo do nervo supraorbital. As pares-

tesias temporárias e algumas irregularidades do músculo frontal são observadas ocasionalmente, mas melhoram, geralmente, dentro de 2 a 3 semanas.

A detecção precoce de assimetria das sobrancelhas no pós-operatório (24 a 48 horas) pode ser melhorada com o reposicionamento da fixação paramediana mediante a reelevação e o deslocamento posterior da gálea/pele a partir do Endotine. A assimetria tardia temporária das sobrancelhas pode ser melhorada com Botox®. A reintervenção é aconselhada quando a assimetria das sobrancelhas persiste e há recorrência evidente de ptose das sobrancelhas.

CUIDADOS PÓS-OPERATÓRIOS

O paciente deve ser tratado com analgésicos durante as primeiras 48 a 72 horas e gelo para diminuir a cefaleia. A cabeça do paciente deve ser mantida elevada para diminuir a congestão venosa e melhorar a drenagem linfática. A massagem linfática, realizada nas primeiras 72 horas por um terapeuta habilitado, diminui o edema e as equimoses, além de melhorar o conforto do paciente e acelerar sua recuperação.

SÍNTESE E CONSIDERAÇÕES FINAIS

A conduta endoscópica para o rejuvenescimento do terço superior da face e *lift* de sobrancelhas apresenta muitas vantagens. Ela fornece excelente exposição para a liberação dos tecidos periorbitais, combinada a grande ampliação endoscópica, cicatrizes menores e redução do risco de alopecia e alterações sensoriais no couro cabeludo. A técnica foi aprimorada ao longo dos últimos 15 anos, com melhores dispositivos de fixação, uma melhor compreensão dos resultados em longo prazo e a diminuição das complicações. Ela oferece ao paciente uma solução muito mais fácil e segura para tratar o envelhecimento do terço superior da face e a assimetria das sobrancelhas.

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Indications:

Chapter 42

FOREHEAD REJUVENATION

Renato Saltz, Omid Adibnazari, Alyssa Lolofie

Indications:
Brow aesthetics cannot be generalized due to a changing of the ideal shape and position of the brow. Although the brow should be evaluated based on gender, ethnicity, orbital shape and overall facial aging and proportions, the main factor to consider is the ratio of the visible eyelid to the palpebral fold. The best candidates for forehead rejuvenation are patients with eyebrow ptosis, asymmetry, temporal hooding and forehead wrinkles. Usually they also have short, flat foreheads and nonreceding hairlines.

Preoperative Preparation:
Assessment of the patient includes evaluation of both the medial and lateral brow position, the ratio from brow to upper eyelid, glabella and forehead lines, forehead shape and height, and the hairline. To assess the strength of the muscle action, movement, and depth of soft tissue folds the patient should be asked to frown as well as to raise the eyebrows. The eyebrows should also be assessed for the thickness, shape, and position. In pre-operative consultation the doctor should advise as to the number of incisions and type of fixations. Based upon the patient assessment, the operation can be planned. Patient inclusion is important in that brow lifts are individualized.

The endoscopic technique is based upon the use of modern technology where the traditional eye-hand surgical coordination is done through a video-endoscopic system. Additional extensive training is necessary not only for the surgeon but all medical and nursing personnel involved in the surgical case. The equipment, from endoscope to camera and monitors, are usually standard in centers where aesthetic surgeries are performed. It has become important to test each system, inspect each instrument and check for a backup system as a safeguard.

Position / Markings:
In preparation for the procedure, the patient is marked from a standing position to utilize the natural positioning of the brows. Markings are made on both sides of the face outlining the temporal ridge, sentinel veins and the assumed position of supratrochlear and supraorbital nerve branches. If the sentinel vein cannot be found from an upright position, patients are asked to lie flat.

The two brow lift vectors are marked. They are determined by lifting the brow manually to the chosen aesthetic position. The lateral vector includes the tail of the brow while the medial vector includes the arch of the brow; both use the lateral canthus, mouth, and ala to determine placement.

Anesthesia:
General anesthesia with a tumescent solution of lidocaine, Marcaine, and epinephrine.

Surgical Technique:
Dissection begins after vasoconstriction. Incisions made from scalp to temporal fascia, preserving sentinel veins, entering subperiosteal plane, using a 4mm 30° endoscope to visualize structures. Fusion ligament divided, supraorbital rim periosteum released, corrugators excised, etc.

Fixation:
Temporal sutures using 3-0 mersilene, excess skin removed, paramedian fixation using Endotine device.

Complications:
Temporary paresthesia, frontalis irregularities, brow asymmetry, alopecia risk, etc.

References:
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Endoscopic Brow Lift – Saltz & Codner

Brow Rejuvenation

Renato Saltz, MD, FACS – United States
ISAPS Board of Directors Trustee, ISAPS Past-President

Indications:
Brow aesthetics cannot be just arch shape and position of the brow. Although the brow should be evaluated based on gender, ethnicity, orbital shape, and overall facial aging and proportions, the main factor to consider is the ratio of the visible eyelid to the palpebral fold. The best candidates for forehead rejuvenation, are patients with eyebrow ptosis, asymmetry, temporal hooding, and forehead wrinkles. Usually, they also have short, flat foreheads, and non-receding hairlines.

Preoperative Preparation:
Assessment of the patient includes evaluation of both the medial and lateral brow position; the ratio from brow to upper eyelid; glabella and forehead lines; forehead shape and height; and the hairline. To assess the strength of the muscle action, movement, and depth of soft tissue folds, the patient should be asked to frown as well as raise their eyebrows. The eyebrows should also be assessed for their thickness, shape, and position. During the pre-operative consultation, the patient should be included and have a mirror to understand the desired position, number of incisions, and types of fixation for the desired new brow (Figure 1).

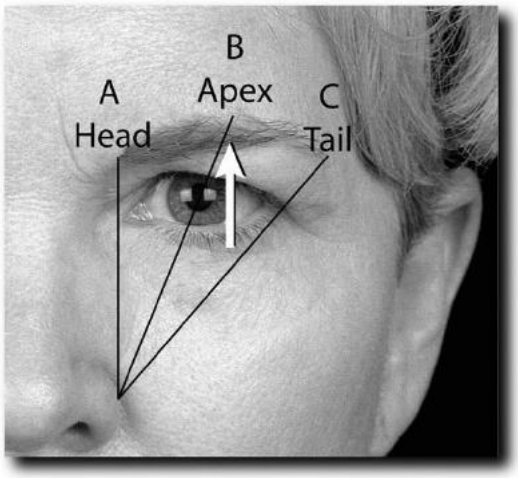

Figure 1. Brow Aesthetics.

The endoscopic technique is based upon the use of modern technology, where the traditional eye-hand surgical coordination is done through a video-endoscopic system. Additional

extensive training is necessary, not only for the surgeon but all medical and nursing personnel involved in the surgical case. The equipment is usually standard in centers where aesthetic surgeries are performed. The surgeon must have knowledge of the principles extending from training, mechanical equipment, and technical skills.

Position/Markings:
In preparation for the procedure, the patient is marked from a standing position to utilize the natural positioning of the brows. Markings should include the temporal ridge, sentinel veins, and the assumed position of supratrochlear and supraorbital nerve branches. If the sentinel vein cannot be found from an upright position, patients are asked to lie flat. Patients are then asked to clench their teeth, and with palpation, the temporalis muscle and temporal crest can be marked. Markings representing the incisions are made 1-2 cm beyond the temporal hairline, checking that the incisions will be over the temporalis muscle. The lateral incision markings should be parallel to the brow, while the paramedian incision will be radial along the midline of the face, forehead, and skull (Figure 2).

The two brow lift vectors are marked. They are determined by lifting the brow manually to the chosen aesthetic position. The lateral vector includes the tail of the brow, while the medial vector includes the arch of the brow; both use the lateral canthus and mouth, and also determine placement. Before infiltration, the hair is cleansed and braided to either side of the chosen incision sites, keeping the hair neatly away from the incision.

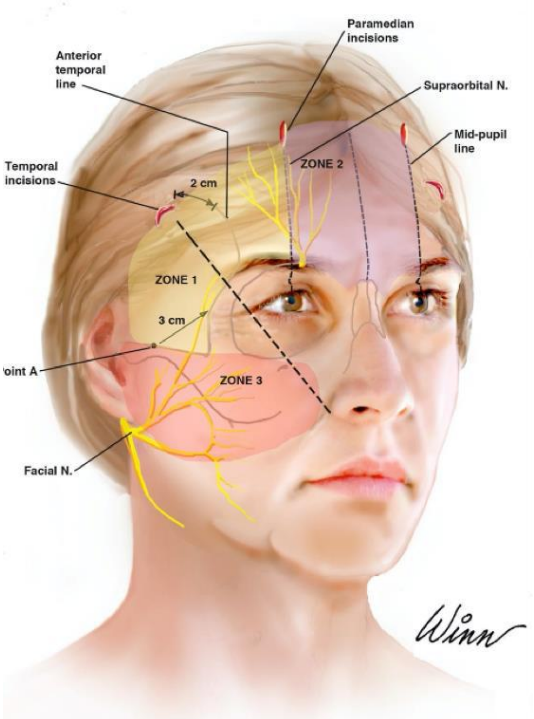

Figure 2. Anatomy and preoperative markings.

Anesthesia:
I prefer general anesthesia with an endotracheal tube using a tumescent local anesthesia solution of 2% Lidocayne, 20 ml of 0.25% Marcaine, and 1 ml of Epinephrine in 140 cc of normal saline.

Surgical Technique

Dissection:
An incision is made from the scalp to the temporal fascia; this allows visualization and dissection to remain on top of the deep temporal fascia. Dissection is carried down to the fusion ligament (temporal ligament) by preserving the sentinel veins intact if possible. Dissection is then turned medially by dividing the temporal ligament and entering the subperiosteal plane. At this point, the dissection continues from the paramedian incisions communicating both pockets (deep temporal fascia with subperiosteal plane) (Figure 3). A 4 mm 30° endoscope is once again calibrated with adequate focus, "white out", irrigation system down, and inserted in the surgical field. The room lights are dimmed down to improve visualization on the screen.

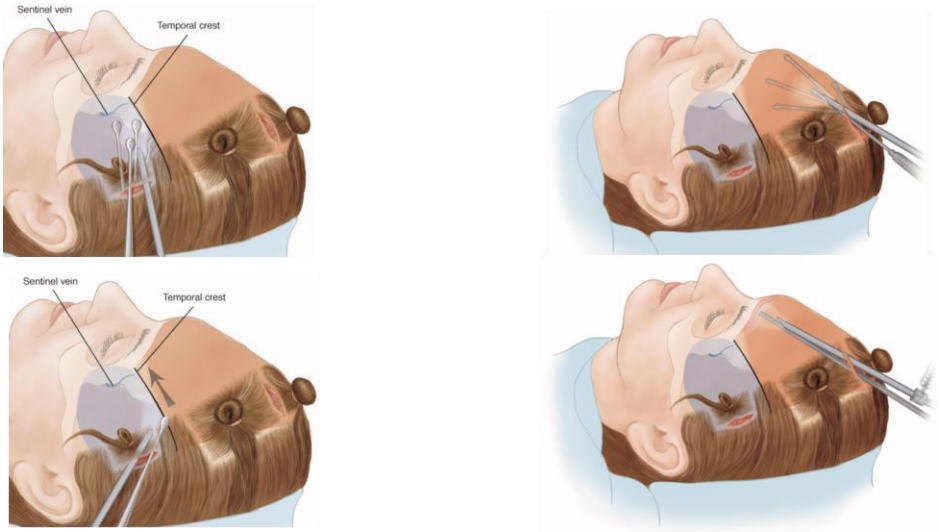

Figure 3. Sequence of temporal and subperiosteal dissection.

With the endoscope at the temporal incision, the sentinel veins are found and preserved, when possible, while the surrounding adhesions are removed. Following the caudal aspect of the temporal crest, the 'fusion ligament" (junction of deep temporal fascia and periosteum) is identified and divided with the endoscopic scissors. The supraorbital rim periosteum is divided from lateral to medial, identifying and preserving the supraorbital neurovascular bundle. The periosteum is then divided from each lateral orbital rim, which serves to allow more lateral brow elevation and provide access to the glabellar musculature. An island of periosteum is preserved at the midline to avoid elevation of the most medial brow. The corrugator muscles are identified and excised/avulsed using endoscopic graspers. The assistant 'pushes' the external skin to help with the corrugators resection, and to allow the surgeon to visualize the dermis and avoid overressection causing an external depression (Figure 4). In case a depression is identified during the procedure, immediate fat grafting is recommended. The completion of the procedure can be tested by moving the brow up and down, which should be mobile at this point. Dissection can continue in a subperiosteal plane along the lateral orbital rim and medial zygomatic arch for midface elevation in a very safe plane (Figure 5). Also, the zygomatic ligament can be easily visualized and divided endoscopically releasing the SMAS in a safer, faster way than traditional SMAS techniques, if a facelift is combined with brow rejuvenation.

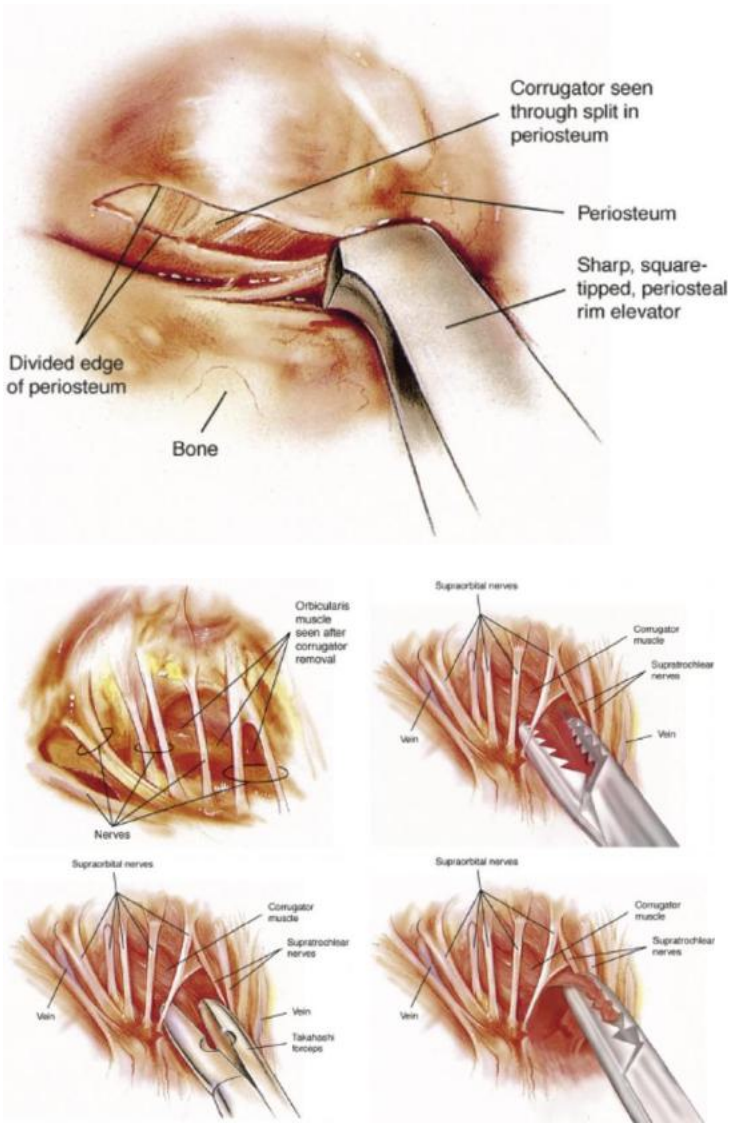

Figure 4. Division of supraorbital periosteum and corrugator ressection.

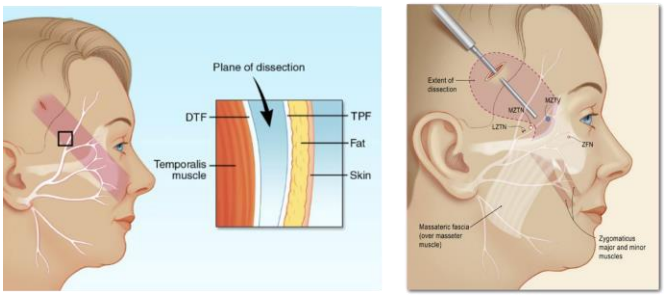

Figure 5. Temporal pocket dissected, and brow fully released.

Fixation:

The temporal fixations are accomplished using interrupted sutures of 3-0 PDS connecting the superficial temporal fascia and the deep temporal fascia. The excess skin is removed, and the

wound closed with 4-0 plain gut. The paramedian fixation is accomplished with the endotine/ultratine devices. They are safely fixated to the outer table with a measured drill hole. The device is then securely inserted followed by digital pressure to hold the periosteum and galea in place (Figure 6). The patient is then assessed in a sitting position while still under general anesthesia. Measurements include pupil-top of the brow and lateral canthus-tail of the brow. The midface fixation is accomplished with Endotine Midface or Ribbon (Microaire). The hair is washed, and the patient is moved to the recovery room. No dressings are applied.

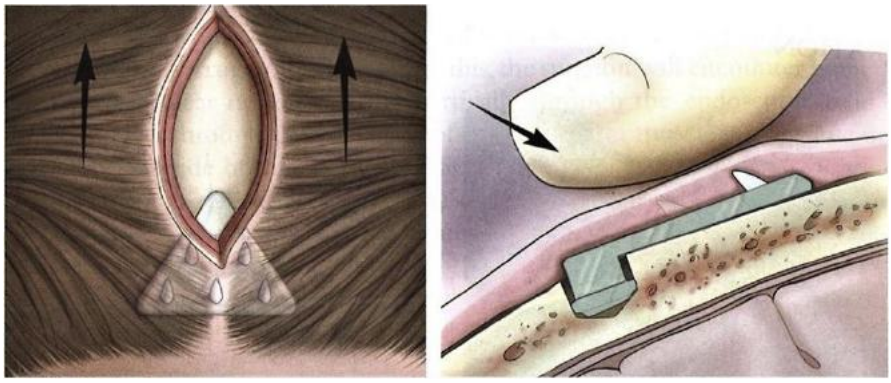

Figure 6. Brow fixation with endotine device.

Complications:
Temporary paresthesia and irregularities of the frontalis muscle can occur occasionally but usually improve within three weeks. Cosmetic problems such as uneven movement of the brows, surface deformities, and elevation of the arch of the brows can sometimes arise. The 'surprised look' can be avoided by keeping a bridge of periosteum at the midline and by avoiding over elevation of the middle third of the brow. Alopecia can be eliminated through the abandonment of percutaneous screw fixations. Early detection of postoperative brow asymmetry (24-48hrs) can be corrected by repositioning the paramedian fixation through re-elevation and posterior displacement of galea/skin from the endotine. Delayed temporary brow asymmetry can be improved with botox. If the brow asymmetry persists and there is obvious recurrence of brow ptosis, re-intervention is advised.

Final considerations:
The endoscopic brow lift results match those of similar 'open' procedures. They provide quicker recovery, fewer complications, and excellent long-term results. The better you can see, the more precise you can be. (Fig 7, 8, and 9)

Recent introduction of non-endoscopic procedures for forehead rejuvenation, like the short scar temporal, the transblepharoplasty, and the anterior hairline approaches, are relatively 'blind.' They offer operative time, no better than endoscopic surgery, blindly dissect around all potential anomalous variations of the supraorbital nerve and require larger incisions with potential damage to the deep branch of the supraorbital nerve, resulting in sensory loss and visible scars. The non-endoscopic, temporal approach is applicable in selected patients where only lateral lift is needed, with no forehead wrinkles, and when no corrugator release is necessary.

The effectiveness and long-term results of the endoscopic brow lift have been well documented. The failure to release the temporal-orbital ligaments, inadequate division of the supraorbital rim periosteum, and lack of proper fixation, have caused early relapse, lack of long-term results, and abandonment of the technique by poorly trained endoscopic surgeons. Also, anecdotal

suggestions that endoscopic operative time is too long, that it creates over-lifting, alopecia, elevates the hairline, widens the interbrow region, and that the results do not last have never been proven right.

Figure 7. Endoscopic Brow Lift combined to Transconjuntival Blepharoplasty. Ultratines used for paramedian fixation and 3-0 PDS for temporal fixation. Follow up at one year.

Figure 8. Endoscopic Brow Lift combined with Endoscopic Midface Lift using 2 temporal and 2 paramedian scalp 1 cm incisions. Fixation of the brow with ultratines and fixation of the midface with the endotine midface device. Follow up at three years.

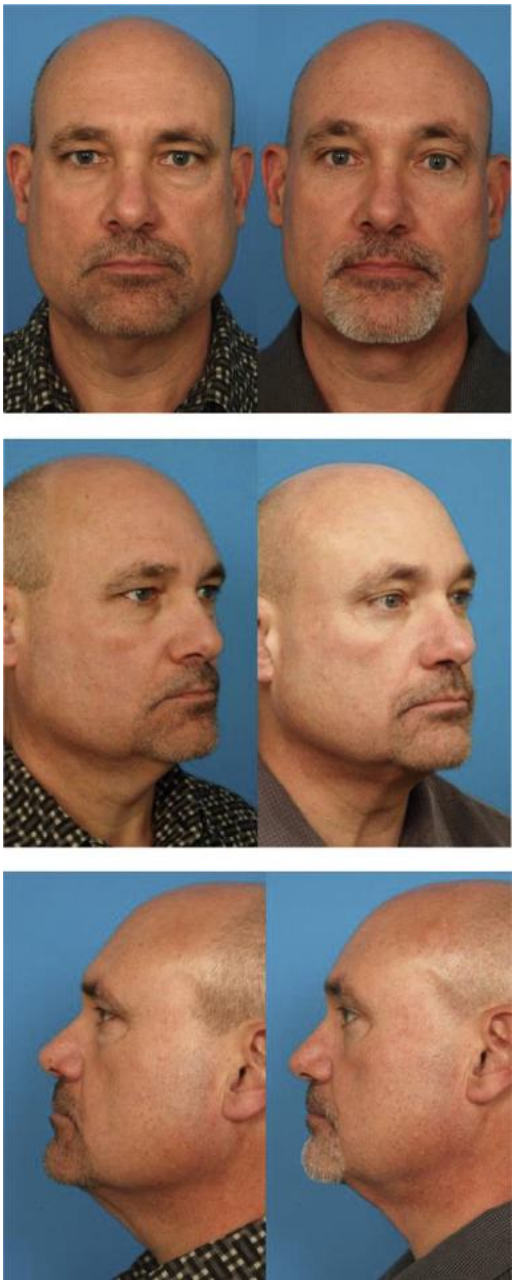

Figure 9. Endoscopic Brow Lift combined to upper and lower blepharoplasty transconjunctival and neck liposuction. Endotines used for paramedian fixation and 3-0 PDS for temporal fixation. Follow up at two years.

Figure 10. Endoscopic Brow Lift 2 temporal and 2 paramedian scalp 1cm incisions combined to facelift and neck lift. Endotines used for paramedian fixation and 3-0 PDS for temporal fixation. Follow up at one year.

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Chapter 40. Forehead Rejuvenation

Renato Saltz; Omid Adibnazari; Alyssa Lolofie

INDICATIONS

Brow aesthetics cannot be generalized because of a changing of the ideal shape and position of the brow. Although the brow should be evaluated based on gender, ethnicity, orbital shape, and overall facial aging and proportions, the main factor to consider is the ratio of the visible eyelid to the palpebral fold. The best candidates for forehead rejuvenation are patients with eyebrow ptosis, asymmetry, temporal hooding and forehead wrinkles. Usually they also have short, flat foreheads and nonreceding hairlines (Fig. 40-1).

PREOPERATIVE PREPARATION

Assessment of the patient includes evaluation of both the medial and lateral brow position, the ratio from brow to upper eyelid, glabella and forehead lines, forehead shape and height, and the hairline. To assess the strength of the muscle action, movement, and depth of soft-tissue folds the patient should be asked to frown as well as to raise the eyebrows. The eyebrows should also be assessed for the thickness, shape, and position. In preoperative consultation the doctor should advise as to the number of incisions and type of fixations. Based upon the patient assessment, the operation can be planned. Patient inclusion is important in that brow lifts are individualized (Fig. 40-2).

The endoscopic technique is based upon the use of modern technology where the traditional eye-hand surgical coordination is done through a video-endoscopic system. Additional extensive training is necessary not only for the surgeon but all medical and nursing personnel involved in the surgical case. (Note from author: The novice should take his or her first assistant to cadaver workshops/courses to learn together.) The equipment, from endoscope to camera and monitors, are usually standard in centers where aesthetic surgeries are performed. It has become important to test each system, inspect each instrument and check for a backup system as a safeguard. The surgeon must have knowledge of the principles extending from training, mechanical equipment, and technical skills.

POSITION AND MARKINGS

In preparation for the procedure, the patient is marked from a standing position to utilize the natural positioning of the brows. Markings are made on both sides of the face outlining the temporal ridge, sentinel veins, and the

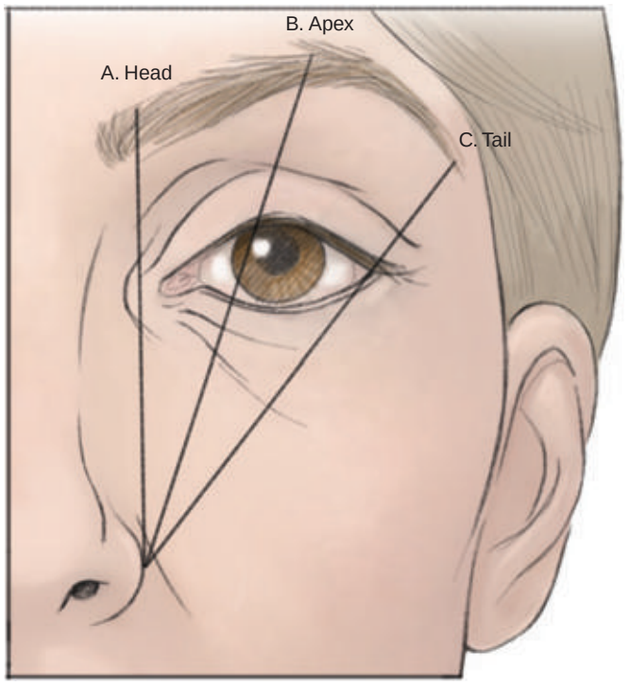

Figure 40-1 Brow aesthetics and ideal patients.

Figure 40-2 Ideal patient picture.

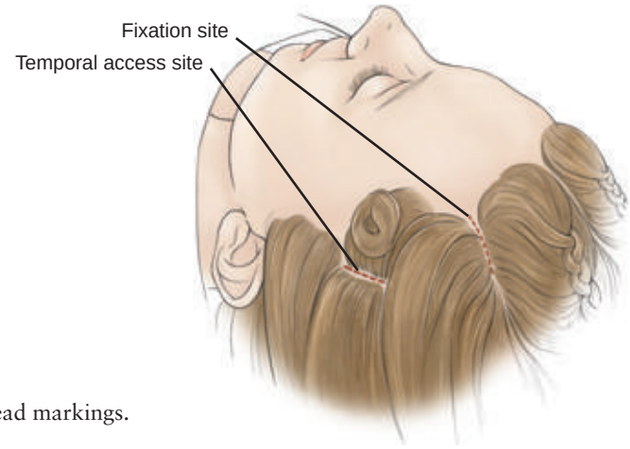

Figure 40-3 Forehead markings.

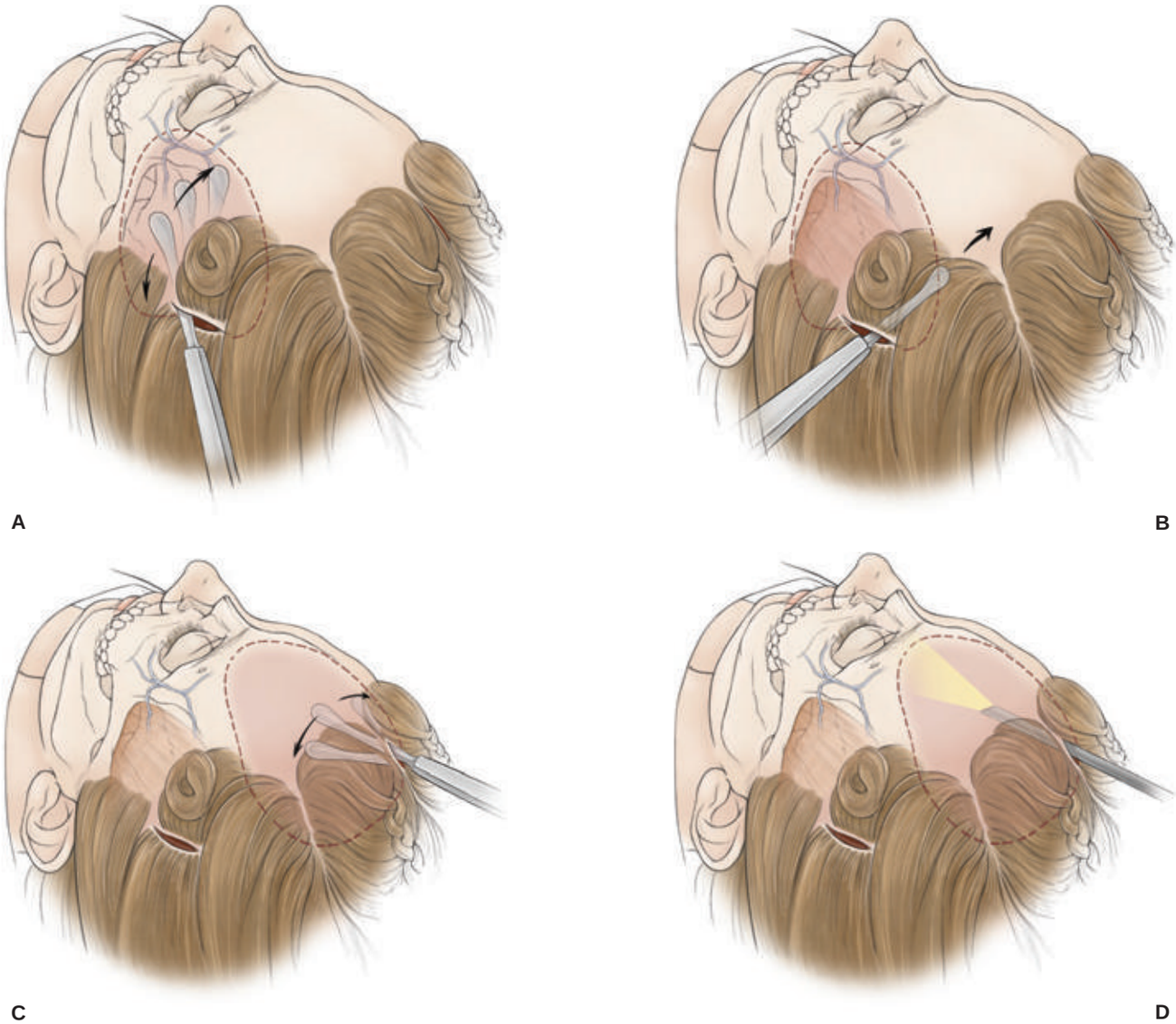

Figure 40-4 Sequence of temporal and subperiosteal dissections.

assumed position of supratrochlear and supraorbital nerve branches. If the sentinel vein cannot be found from an upright position, patients are asked to lie flat. Patients are then asked to clench their teeth, and with palpation, the temporalis muscle and temporal crest can be marked. Markings representing the incisions are made 1 to 2 cm beyond the temporal hairline, checking that the incisions will be over the temporalis muscle. The lateral incision markings should be parallel to the brow while the paramedian incision is radial along the midline of the face, forehead, and skull.

The 2 brow lift vectors are marked. They are determined by lifting the brow manually to the chosen aesthetic position. The lateral vector includes the tail of the brow while the medial vector includes the arch of the brow; both use the lateral canthus, mouth, and ala to determine placement. Before infiltration, the hair is cleansed and braided or stapled to either side of the chosen incision sites. This keeps the hair neatly away from the incision sites (Fig. 40-3).

ANESTHESIA

The most common approach for the patient is general anesthesia with an endotracheal tube that is attached with dental floss to the teeth. Infiltrate the site using a 20-gauge spinal needle in a tumescent fashion with a solution of 2% lidocaine, 20 mL of 0.25% Marcaine, and 1 mL of epinephrine in 140 mL of normal saline. The patient should then be prepped and draped in a standard sterile manner.

SURGICAL TECHNIQUE

Dissection

The procedure may begin after 20 minutes from infiltration to increase vascular constriction. An incision is made from the scalp to the temporal fascia; this allows visualization and dissection to remain on top of the deep temporal fascia. Dissection is carried down to the fusion ligament by preserving the sentinel veins if possible. Dissection is then turned medially by dividing the temporal crest with a periosteal elevator and continuing the dissection in a subperiosteal plane. At this point the dissection continues from the paramedian incisions communicating both pockets (deep temporal fascia with subperiosteal plane). A 4-mm 30-degree endoscope is once again calibrated with adequate focus, "white out," irrigation system down and inserted in the surgical field. The room lights are dimmed down to improve visualization on the screen (Fig. 40-4).

With the endoscope at the temporal incision, the sentinel veins are found and preserved when possible while the surrounding adhesions are removed. Following the caudal aspect of the temporal crest the "fusion ligament" (junction of deep temporal fascia and periosteum) is identified and divided with the endoscopic scissors. The supraorbital rim periosteum is divided from lateral to medial while identifying and preserving the supraorbital

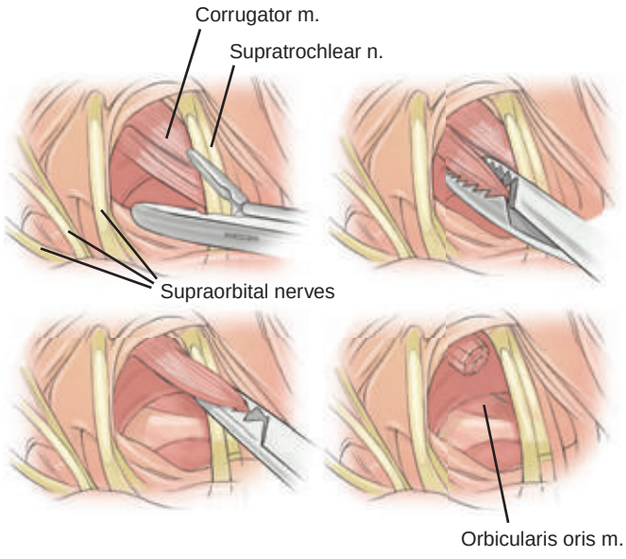

Figure 40-5 Corrugators resection.

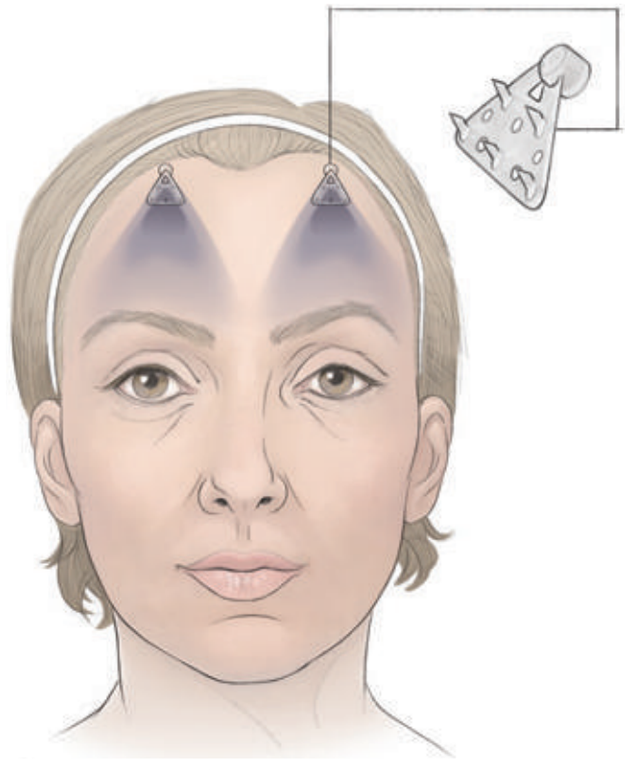

Figure 40-6 Brow fixation with Endotine device.

neurovascular bundle. The periosteum is then divided from each lateral orbital rim, which serves to allow more lateral brow elevation and provide access to the glabellar musculature. An island of periosteum is preserved at the midline to avoid elevation of the most medial brow. The corrugator muscles are identified and excised/avulsed using endoscopic graspers. The assistant "pushes" the external skin to help with the corrugators resection and to allow the surgeon to visualize the dermis and avoid overresection, causing an external depression. In case a depression is identified during the procedure, immediate fat grafting is recommended. The completion of the procedure can be tested by moving the brow up and down, which should be mobile at this point (Fig. 40-5).

Fixation

The temporal fixations are accomplished using 3 interrupted sutures connecting the superficial temporal fascia and the deep temporal fascia using 3-0 Mersilene sutures. The excess skin is removed and the wound is closed with 4-0 plain gut. The paramedian fixation is accomplished with the Endotine device. The Endotine device is safely fixated to the outer table with a measured drill hole. The device is then securely inserted followed by digital pressure to hold the periosteum and galea in place. The patient is then assessed in a sitting position while still under general anesthesia. Measurements include pupil-to-brow and lateral canthus-to-tail of brow. The hair is washed and the patient is moved to the recovery room. No dressings are applied (Fig. 40-6).

Complications

Temporary paraesthesia and irregularities of the frontalis muscle will occur occasionally. However, it usually improves within 3 weeks. Cosmetic problems such as uneven movement of the brows, surface deformities, and elevation of the arch of the brows can sometimes arise. The "surprised look" can be avoided by keeping a bridge of periosteum undivided at the midline and by avoiding over elevation of the middle third of the brow. Alopecia can be eliminated through the abandonment of percutaneous screw fixations. Early detection of postoperative brow asymmetry (within 24 to 48 hours) can be improved by repositioning the paramedian fixation through reelevation and posterior displacement of galea/skin from the Endotine. Delayed temporary brow asymmetry can be improved with Botox. If the brow asymmetry persists and there is obvious recurrence of brow ptosis, reintervention is advised.

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AQ1

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AQ2

AUTHOR QUERY

AQ1: Please add reference citations in text.
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Full SMAS: Endoscopy-Assisted Full Facial Rejuvenation

Carlos Casagrande, MD; Emilio Facin, MD; and Renato Saltz, MD

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Abstract

Background: Every region of the face may bear the signs of aging. Treating isolated areas without adequate anatomical knowledge can lead to incomplete or artificial-looking results and decrease patient satisfaction. The authors' "Full SMAS" technique for complete rejuvenation addresses the anatomical continuity of the superficial musculoaponeurotic system (SMAS)-platysma to the deep-plane suspension of the face.

Objectives: The aim of this study was to evaluate the contribution of endoscopic techniques to traditional facelift and neck lift procedures. Procedures treating from the frontal and temporal regions of the superior part of the face to its mid and lower parts, including the cervical region, were evaluated.

Methods: Treatment of the 3 sub-SMAS layers of the face was performed using endoscopy for repositioning the frontal region and midface. This procedure involved frontal and zygomatic-masseter ligament release, open treatment of the lower subplatysmal section, and the complete release of the retaining ligaments of the face and approach to the jowl.

Results: One hundred sixty-one patients underwent the Full SMAS technique, leading to long-lasting results, low complication rates, and high patient satisfaction.

Conclusions: The Full SMAS is a systematic technique that provides complete facial rejuvenation by combining an endoscopic approach for the temporal and midface regions with traditional open approaches for the lower face and neck. Treating the temporal and midface regions by minimally invasive techniques (endoscopy) reduces the possibility of permanent nerve injuries, provides smaller scars, and creates natural, long-lasting results.

Level of Evidence: 4 (Therapeutic)

Facial aesthetic surgery is undeniably complex because several aspects need to be considered during its execution, such as the patient's race, the structural characteristics of the patient's face, and the patient's desires.[1,2] Numerous techniques for performing the same procedure are now available. Nevertheless, there is a consensus in modern facial surgery centered on treating the face in a deep plane by intervening in the layer of the superficial musculoaponeurotic system (SMAS) and the platysma muscle. Several different approaches are currently available. The most common facial rejuvenation surgery techniques include plication[3] and the minimal access cranial suspension lift,[4] neither of which involve deep dissection of the SMAS; Baker's SMASectomy, which removes a lateral band of the SMAS;[5,6] and sub-SMAS approaches, such as composite lift, in which the elevation of a SMAS-skin flap is recommended.[7,8] In the high SMAS technique, dissection of the SMAS flap starts above the zygomatic arch;[9,10] while in the deep plane technique, the sub-SMAS approach occurs from a line that goes from the lateral orbital region to the mandibular angle and aims at elevating the medial mobile SMAS.[11,12]

In our view, the most natural and efficient surgical results are achieved when working on the 3 facial regions of the face together. Treating just 1 or 2 regions of the face when a global approach is required can lead to an inadequate outcome and patient complaints. There is also a growing demand for long-lasting results that mask the signs of surgical intervention.[1,2,13,14] The observation that each facial region contributes to the signs of aging led to the development of the "total face" concept and technique.[2]

We believe that the most critical factor for the success of global facial rejuvenation surgery is standardization of the surgical technique to encompass the many variables involved in these treatments. Therefore, it is particularly important to perform a thorough preoperative evaluation to identify which age-related changes to improve surgically. In addition, factors such as equipment preparation, the type of anesthesia to use, the preparation of sterile fields, the sequence of the surgical steps, postoperative indications, and patient follow-up in the clinic should also be taken into consideration.[1,2]

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All modern facial surgeries focus on the SMAS-platysma, which is anatomically continuous through all the facial segments from the epicranial fascia to the clavicle.[15] Our "Full SMAS" technique takes this anatomical continuity into account.[15] The surgical approach used with this technique follows the continuous stratigraphic plane, from the frontal region to the lower cervical region, disconnecting the SMAS lamina from the deep planes through the release of ligaments.[2]

Hence, this study standardizes several surgical techniques, resulting in the Full SMAS technique offering a unified approach for total facial rejuvenation. This technique is based on treating deep structures of the facial regions through ligament release in the 3 parts of the face, from the zygomatic-masseteric ligaments (using endoscopy), through the platysma-auricular release and treating the platysmal band by the preauricular route, to the treatment of jowl structures, aiming to achieve a better jawline definition. Thus, the Full SMAS technique allows for the suspension of the 3 facial regions, with complete repositioning of the eyebrows, the anterior and lateral regions of the midface, and the cervical contour.[2]

METHODS

Sample Design

A retrospective evaluation was conducted on 161 patients who underwent the Full SMAS technique between January 1, 2016 and December 31, 2020. Postoperative evaluation of patients was conducted 30, 60, 90, 180, and 360 days after the procedure. Consent was obtained from all patients. The surgeon considered patient feedback and observed the results to establish a personal opinion of the outcomes in relation to previous experience with different procedures. We adhered to ethical principles for medical research involving human subjects according to the Declaration of Helsinki. All patients had clinical indications for complete facial rejuvenation, including the frontal and cervical regions and midface. In the frontal region, the alterations were related to varying degrees of ptosis of the eyebrows, glabellar wrinkles, temporal atrophy, excess skin, and upper and lower eyelid pockets. In the midface, the patients showed marked eyelid-malar grooves and loss of malar volume. In the cervical region, patients showed undefined jawlines, mandibular edges with excess skin and fat, and tissue flaccidity. Exclusion criteria included patients who had previously undergone facial surgery (secondary surgery), those who presented with autoimmune diseases or previous facial trauma, and those who used prophylactic anticoagulants during the postoperative period. The same surgeons and anesthesia teams performed all surgeries in 2 different hospitals for all patients. In all cases, endoscopic surgery was used to approach the frontal region and the midface, along with open surgery on the lower aspect of the face (Video).

Figure 1. Scalp incisions for endoscopic access.

Anesthesia

The anesthesia team remained consistent for all patients. In each case, local anesthesia was combined with intravenous sedation or general anesthesia. A standard solution of lidocaine 2% with epinephrine (1:200,000) was used to infiltrate regional blocks of sensitive nerve trunks of the face (supraorbital, supratrochlear, and infraorbital branches). Then, infiltrative anesthesia was performed through the temporal and frontal endoscopic access portals. The temporal crest, the periorbital region, and the middle third were also infiltrated. Lower volumes were injected into the supraperiosteal plane of the midface. This was followed by infiltration of the area of preauricular detachment, the path of the pre- and retroauricular incision, and finally, the cervical and jowl regions.

Endoscopic Surgery of the Temporal and Frontal Regions and the Anterior Midface

Temporal Region

The temporal, frontal, and midface regions are approached using an endoscopic technique. A 4-mm, 30° endoscope is inserted through several incisions: two 2- to 3-cm-wide temporal incisions are made 2 cm from the hair implantation line and in the same direction as that of an imaginary line passing lateral to the nasal ala to the lateral canthus; two 1-cm paramedian incisions are made at the hair implantation line following the midpupil lines; and, if necessary, one central incision is made in between the paramedian incisions to better approach the corrugator and procerus muscles (Figure 1).

Dissection through the temporal incision begins in the plane above the temporal fascia, in the upper temporal space. It is essential to start the dissection in the correct plane by creating a small opening of the fascia to visualize the temporalis muscle immediately underneath. The temporalis muscle fascia then undergoes delamination from the upper orbital margin. At this level, the fascia is a single leaflet, which then subdivides into 2 thinner leaflets, the deep and superficial temporal fasciae. This anatomical feature is relevant because the dissection should not reach the level of the deep fascia. It is critical to stay on the right plane: a deeper dissection may reach the richly vascularized deep fat pad of the temporal region, and the resulting bleeding could hinder visualization in the endoscopic field; a more superficial dissection could reach the superficial fatty pad through

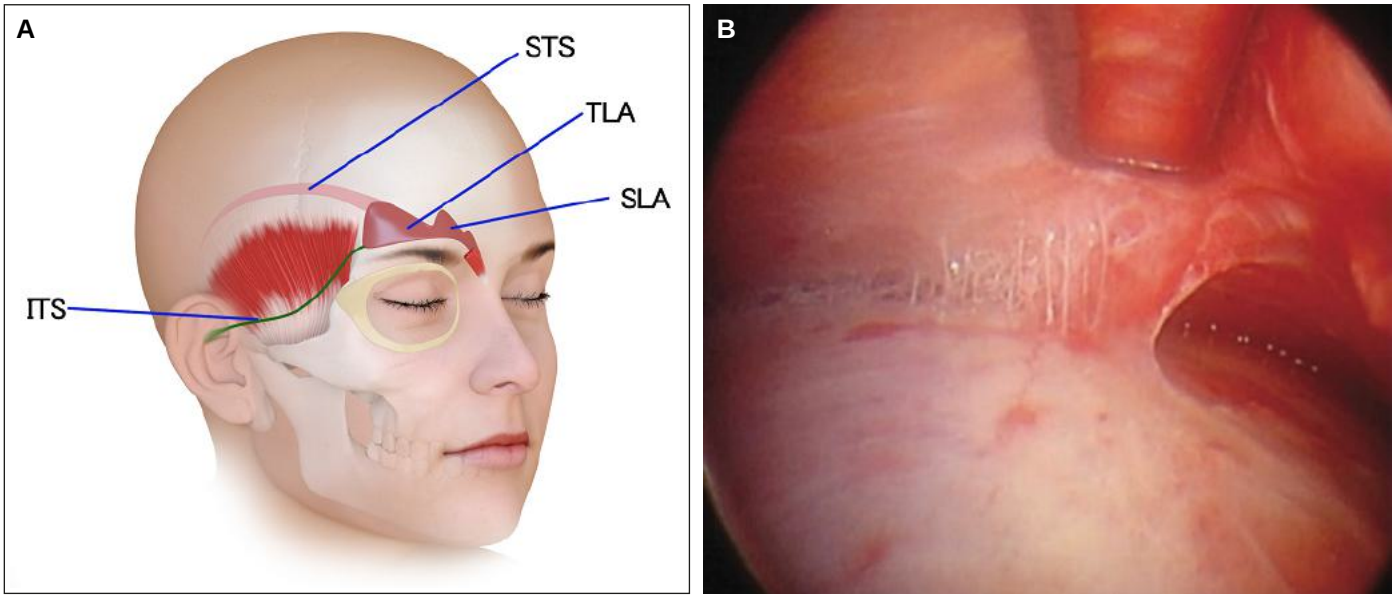

Figure 2. Anatomy and procedure on the temporal region. (A) Temporal septum and adhesions. (B) Endoscopic view showing the continuity of the frontal subperiosteal plane with the temporal subfascial plane after detachment of the temporal crest. ITS, inferior temporal septum; STS, superior temporal septum; TLA, temporal lateral adhesion; SLA, superior lateral adhesion.

which the temporal branch of the facial nerve transverses and could potentially cause nerve damage.

When the dissection reaches this point (the upper orbital margin), it is essential to exercise a high degree of caution to avoid leaving the correct anatomical plane. This plane is avascular and remains so until the sentinel vein is reached. The sentinel vein is a perforating vessel that emerges approximately 2.5 cm laterally and 1.8 cm superiorly to the lateral corner of the eye, towards the temporal branch of the facial nerve. These veins can vary in position, caliber, number, and even be absent. In our experience, cauterizing the sentinel vein allows for a wider release of all the lateral periorbital ligaments and the supraorbital adhesions, even when only performing a frontal lift without any midface component, thereby ensuring a lasting and predictable result for the elevation of the lateral edges of the eyebrows. Although cauterizing the sentinel vein is not essential, it facilitates the dissection of the midface. The sentinel vein can easily be disrupted during manipulation of nearby tissue, causing considerable bleeding on the endoscopic field, delaying the procedure, and causing a potential risk of temporal branch injury when attempting cauterization. Another important detail is that cauterizing the sentinel vein should be done as close as possible to the deep fascia to avoid thermal injury to the superficially positioned temporal branch of the facial nerve (Supplemental Figure 1).

After cauterizing the sentinel vein, the next step of the dissection is to join the suprafascial temporal plane with the frontal subperiosteal plane, with lysis of the anterior temporal line. The periosteal elevator is placed in the dissected temporal area, and then, with firm movement in the medial direction, the temporal adhesion in the subperiosteal plane is forcibly detached. This movement can be done blindly up to and near the orbital margin to enlarge the optical cavity and allow greater mobility for handling the equipment. After this maneuver, the endoscope is finally inserted to release the anterior temporal line and the orbital ligament. With the aid of scissors or a sharp periosteal elevator, a wide release of this ligament is made to generate access to the subperiosteal plane of the supraorbital region (Figure 2).

The blunt temporal dissection advances towards the lower edge of the medial zygomatic arch on a supraperiosteal plane. The zygomatic ligament is found in this region. Some temporal, zygomatic sensory branches are also identified during this dissection and can be cauterized if necessary. The lower dissection limit is the region of the lower edge of the zygomatic arch because the temporal branch emerges from the parotid gland in this area. Medially, the wider and blunt periosteal elevator instrument is forced downwards towards the labial commissure of the mouth. Thus, the medial region of the midface is accessed in the supraperiosteal plane, which will be joined with the dissection plane made by releasing the zygomatic ligament. A small subperiosteal detachment is made in the inferior orbital ridge, allowing correction of the eyelid-malar groove when necessary (Supplemental Figure 2). The supraperiosteal dissection of the lateral orbital margin is performed in the malar region. The zygomatic major muscle defines the limit of lateral dissection (Figure 3). The dissection proceeds bluntly just supraperiosteal to the oral space and nasolabial folds, elevating the entire anterior area of the midface. The same dissection is performed on the contralateral side after the end of the temporal and midface dissection.

Frontal Region

Detachment can be performed blindly through the frontal incisions as far as approximately 2 cm above the superior orbital margin. The endoscope is then introduced in the location where the periosteum is completely opened, joining the 2 temporal dissections. The opening of the periosteum begins in the glabella (Supplemental Figure 3). With the aid of scissors, a small incision is made, and from this point, the periosteum is divulsed by moving in the craniocaudal direction along the nerve fibers. After opening the periosteum and identifying the supratrochlear and supraorbital nerves, myotomies or muscle avulsion are initiated. The endoscope must be positioned in such a way as to keep the flap tense and allow for detailed visualization of the region. The procerus muscle is more vertical than the glabella and is positioned centrally to the supratrochlear vascular-nervous pedicle. With divulsing movements, the origin and insertion portions of the muscle are removed by means of closed scissors or an endoscopic grasper (Supplemental Figure 4). The surgeon's assistant should place their index finger exactly over the skin where the endoscopic dissection is taking place (lateral to the glabella and on top of the corrugator region) to help guide the endoscopic dissection, to avoid accidental grasping of the dermis and overressection of corrugator and procerus muscles

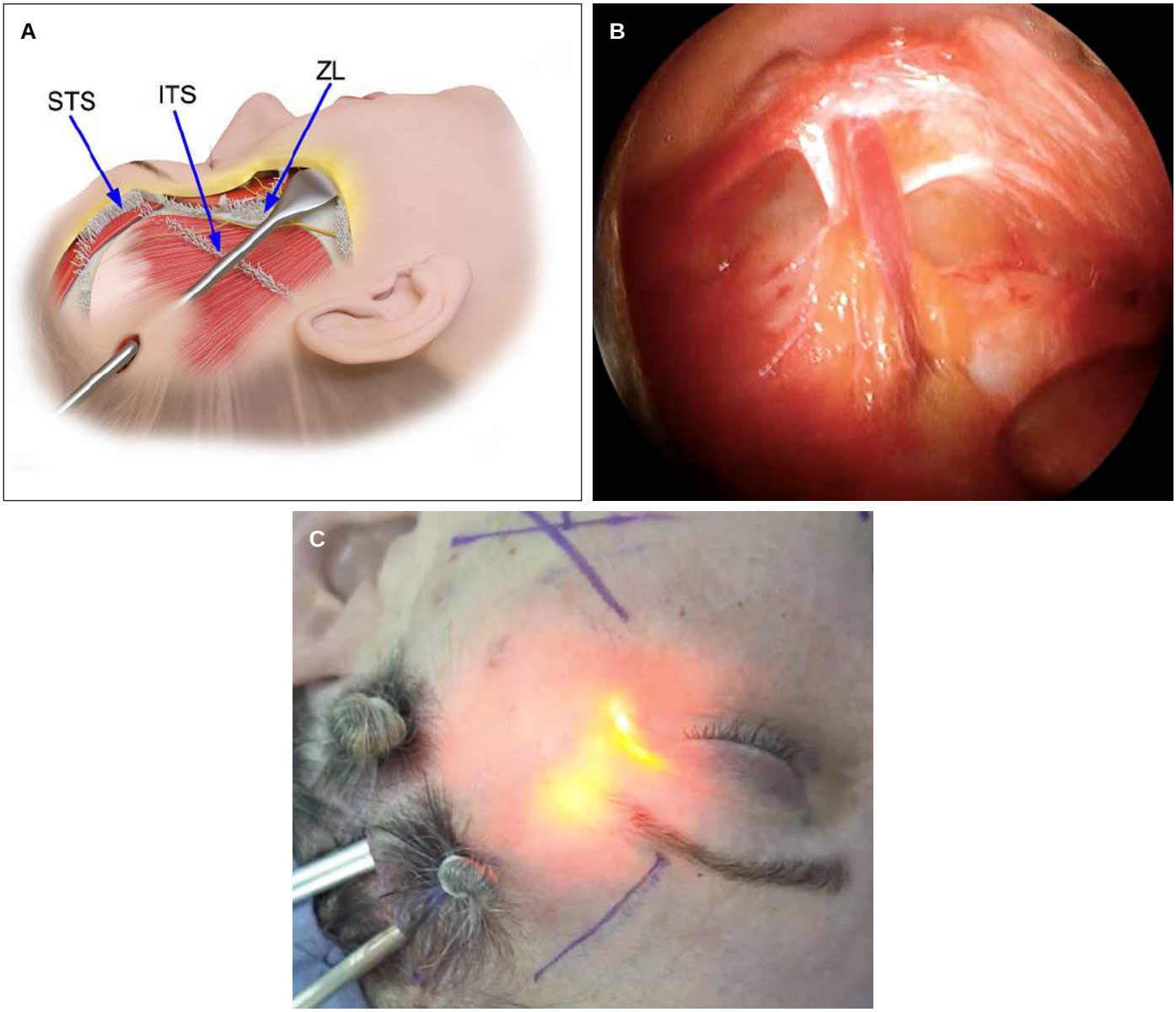

Figure 3. Procedures on the midface demonstrated in a 50-year-old female patient. (A) Three-dimensional drawing showing the detachment of the zygomatic masseteric ligament (ZL), and the superior temporal septum (STS) and inferior temporal septum (ITS). (B) Endoscopic limit of lateral dissection of the midface, corresponding to superficial zygomatic major muscle detachment. (C) External limit of lateral dissection of the midface.

(causing indentation), and to protect the surgeon from accidental skin burns when using endoscopic cautery which often cannot easily be visualized in the endoscopic field.

The large corrugator muscle, located obliquely to the upper orbit, varies according to the morphology of each patient's face. The fibers of this muscle intermingle with the supratrochlear vascular-nervous pedicle superficially. A good myotomy requires dissection between the nerve fibers to locate the muscle fibers, which can be divulsed with an endoscopic grasper or incised with scissors. Electrocautery can be used to maintain hemostasis of the muscle belly. Care must be taken to avoid burning the adjacent skin, as the magnified endoscopic image may give a false idea of distance.

At this level of dissection, the supraorbital adhesions will be accessible. These are resistant connective tissues located between nerves and muscles. The superciliary release depends on the myotomies and the dissection of these adhesions. Thus, the usual technique is to dissect the supraorbital adhesions to varying depths. A wide release ensures a long-lasting result, giving a more intense degree of tissue elevation in cases in which the superciliary ptosis is complete and more pronounced.

After dissecting the muscles and adhesions, the subcutaneous level is reached. From this point on, it is unnecessary to continue the dissection. Continuing with the dissection may result in superciliary detachment and, over time, an exaggerated elevation of the eyebrow due to the constant pulling action of the frontal muscle. Depressions due to a lack of fatty tissue may still be observed (more commonly in the glabellar region). In thin patients, the orbital margin may be visible due to the narrow thickness of the skin flap, especially at the level of the lateral edge of the eyebrows.

Fixation Procedures

An Endotine Ribbon or an Endotine Midface device (Microaire Surgical Instruments, Charlottesville, VA) can be introduced through

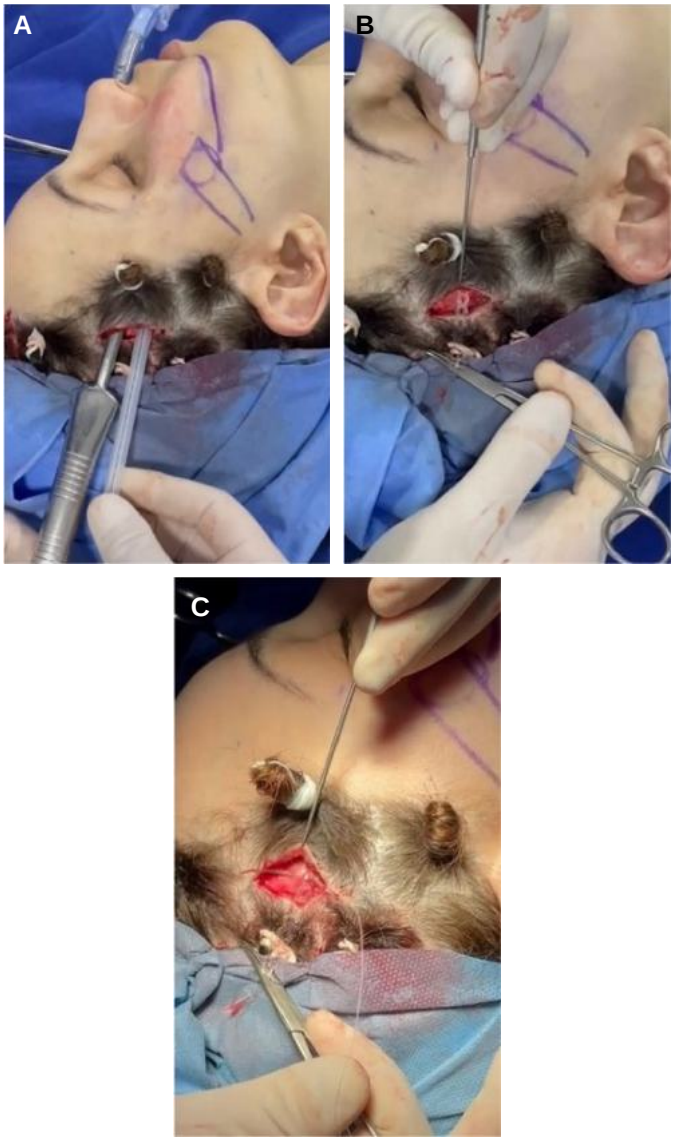

Figure 4. Fixation of the midface with Endotine Ribbon demonstrated in a 50-year-old female patient. (A) Once positioned at the oral space. (B) The fixation device is removed from its case, fixing the part containing the claws to the moving midface area. (C) The fixation point in the temporal fascia is created with multifilament 3-0 nylon thread.

the temporal incision to fix the tissues of the midface to the temporal fascia. Once positioned at the oral space, the fixation device is removed from its case, fixing the part containing the claws to the moving midface area. The device is then suspended by pulling the device's tape and fixing it to the temporal fascia (Figure 4).

Another option for fixating the midface is direct fixation using a Casagrande needle.[1,2] This technique uses strategic fix points in the face to allow for vertical lifting. In the temporal region, the first point (N1) follows a direction determined by an upper vertical vector guiding the desired raise of the eyebrow tail. This point is placed on the temporal flap at the level of the anterior temporal line because this is the location of the underlying temporal fascia required for suturing and obtaining traction, mainly in the vertical direction. The second point (N2) is placed on the precapillary line along the extension of an imaginary line starting in the midface (Figure 5).

Other devices, such as the Endotines described by Saltz et al, may be used to fixate the central and superior parts of the frontal region of the face.[13,14] For these techniques, conduits are drilled in the first layer of the frontal bone, caudally to the incisions along the midpupillary midline, to fixate the Endotine device. After fixation, the frontal region periosteum is tightly applied over the tines of the device until the desired suspension is achieved, moving lateral soft tissues more medially, "rounding" the temporal area and providing an elegant soft cephalic elevation of the lateral brow in women. In men, the elevation is very upward, creating a symmetric, straight, masculine brow. The aim is to avoid elevation of the lateral brow in men, which can cause "feminization" of the brow.

Eyelid Treatment

Video-assisted surgery changes the indications for eyelid treatment, resulting in less frequent or smaller skin resections. Another relevant aspect is the preservation of the functional integrity of the orbicularis oculi muscle, maintaining its tonus in the postoperative period and significantly decreasing the occurrence of immediate or late complications. The upper eyelid is traditionally treated by removal of excess skin and, if necessary, removal of fatty bags. We prefer to remove excess skin of the upper eyelid after completion of the endoscopic brow lift. This avoids excessive skin removal and the risk of inherent complications.

In the lower eyelid, transconjunctival access to the fatty bags is prioritized. In addition, if excess skin is observed, excision without detachment, the "no-touch technique" described by Glenn Jelks, is used almost exclusively.[16] In this technique, the area near the ciliary margin is clamped, and the excess skin is removed with delicate scissors. A lower level of trauma in the lower eyelid increases the probability that the eyes will maintain their normal level of coverage and lubrication. Another treatment option for lower eyelids in patients with mild to moderate excess skin involves the use of different intraoperative methods of thermal and/or chemical peels.

Open Approach: Lateral Side of the Midface and Lower Floor of the Face

After the endoscopic dissection of the temporal, frontal, and midface regions is completed, the "endoscopic pocket" is packed with epinephrine-soaked gauze and left intact until the lower face and neck are treated. This keeps the area dry and avoids further bleeding and later bruising. In addition, having the gauze in this area facilitates and expedites the SMAS dissection via the open approach and the development of the "deep plane" and "SMASectomy" when these techniques are indicated.

Lower Middle Floor

The procedure starts with liposuction of the jowl and cervical region, with, in most cases, reduced fat removal to avoid producing too thin a flap. In most patients, the jowl is approached with an incision to treat alterations that reduce the chin angle and marked platysmal bands. These alterations are the subplatysmal fat and the protruding digastric muscle. The suturing of the platysmal bands, plication or shaving of the digastric muscle, and removal of sub- and interplatysmal fat are frequently performed to improve the chin angle.

Reduced preauricular, retrotagal, and retroauricular incisions are performed to complement the approach to the posterior part of the midface and lower cervical region (Figure 6). The detachment is preauricular and subcutaneous, maintaining the flap with as much thickness as possible without damaging the SMAS. The detachment is extensive enough to perform the SMAS flap and complementary release of the masseter ligament. Subcutaneous detachment of the cervical region is also performed. Joining subcutaneous dissection to the contralateral side is usually indicated.

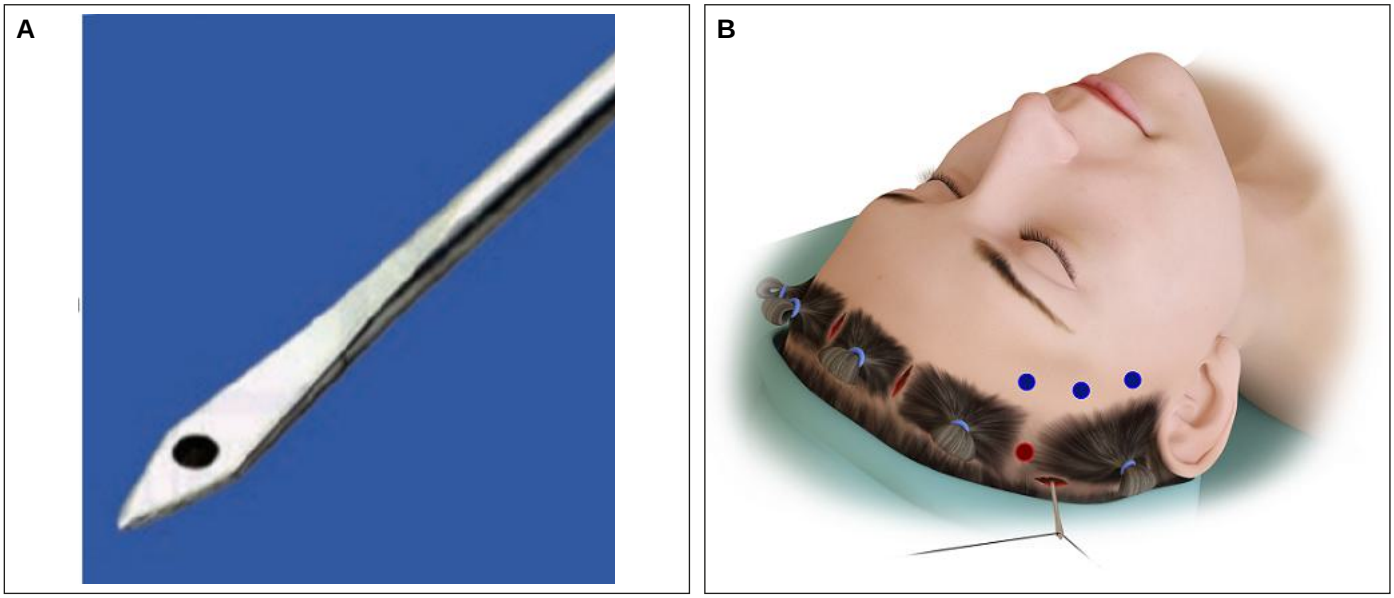

Figure 5. Fixation procedures. (A) Casagrande needle. (B) Needle introduction and fixation points (blue temporal dots): one in the direction of the tail of the brow, the second one in direction of the middle third, and the last one at the end of the inferior temporal dissection next to the superior portion of the zygomatic arch. The red dot located on the patient's scalp indicates the point to accommodate the skin excess.

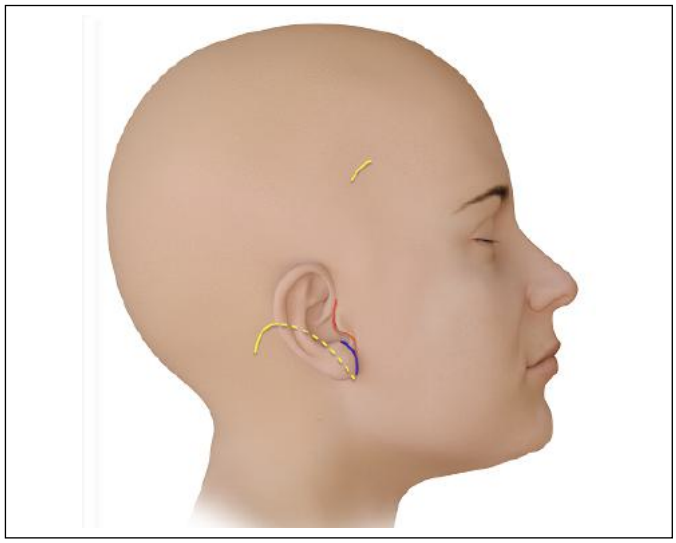

Figure 6. Incisions in Full SMAS concept. Frontal yellow line represents the video incisions. Yellow retroauricular line represents incision to cervical approach. Preauricular reduced incisions (blue and red lines) are performed to complement the approach to the posterior part of the midface and lower cervical region as needed.

After complete skin flap detachment, the SMAS-platysma is treated. The most common approach is to construct an SMAS-platysma flap, which allows deep plane traction. The extent of SMAS-platysma flap dissection differs for each case. The deep plane entry of the SMAS is routinely performed in the SMASectomy line, as described by Baker, through an imaginary line going from the lateral canthus passing posterior to the mandibular angle and in front of the sternocleidomastoid muscle (Supplemental Figure 5).[5,6]

Subplatysmal dissection begins by creating a subplatysmal tunnel, always under direct visualization and with the aid of a fiberoptic retractor. At this point, attention should be paid to the presence of the external jugular vein, which is covered by the caudal portion of the platysma in most cases and may show a lateral and superficial path as dissection advances to the cephalic section. Then, partial or complete platysmotomy is performed. This procedure starts about 4 to 6 cm from the mandibular ramus, using electrocautery, separating the muscle fibers and the subplatysmal fascia, following the midline towards the cricoid cartilage (Supplemental Figure 6). After the platysmotomy, release of the caudal platysma ligament is performed, which is essential to allow the definition of the mandibular angle and the elevation of the SMAS-platysma.

After treatment of the cervical portion of the platysma, detachment of the SMAS flap in the midface is performed. The detachment starts just beneath the zygomatic arch region to the angle of the mandible, progressing to the anterior part of the face for the complementary release of the masseteric ligament. The extent of the sub-SMAS dissection will depend on the degree of ptosis of the face structures (Supplemental Figure 7). It is noteworthy that the entire midface area would have previously been endoscopically dissected.

After its complete release, the SMAS-platysma is fixated. At the first point, the superior portion of the SMAS is anchored to the parotid fascia. At the second point, the platysma flap is anchored to the infra-auricular mastoid region, and the space between the edges of the remaining SMAS is sutured. A platysmal sling is thereby formed, covering the mandibular ramus and repositioning the lateral side of the midface (Figure 7).

At this point, application of the internal hemostatic suture (IHS) described by Casagrande et al is initiated, dramatically decreasing the formation of hematomas.[2] First, a simple 3-0 Prolene (Ethicon, Inc., Raritan, NJ) thread knot is made above the sideburns, with the needle entering the hair region and exiting by the detached layer. A continuous suture is made below the skin with the same thread, joining the flap with the SMAS underneath. When reaching the topography of the mandibular angle, the needle crosses the skin and enters again, leaving an exposed loop to remove the thread easily. The IHS then continues to the retroauricular incision, passing underneath it and ending within the hairline (Supplemental Figure 8). In most cases, 2 parallel IHSs are used. The incisions are sutured in planes. At the end of the surgery, the patient's hair is washed after extubation, and an elastic band is placed to gently compress the neck and middle third.

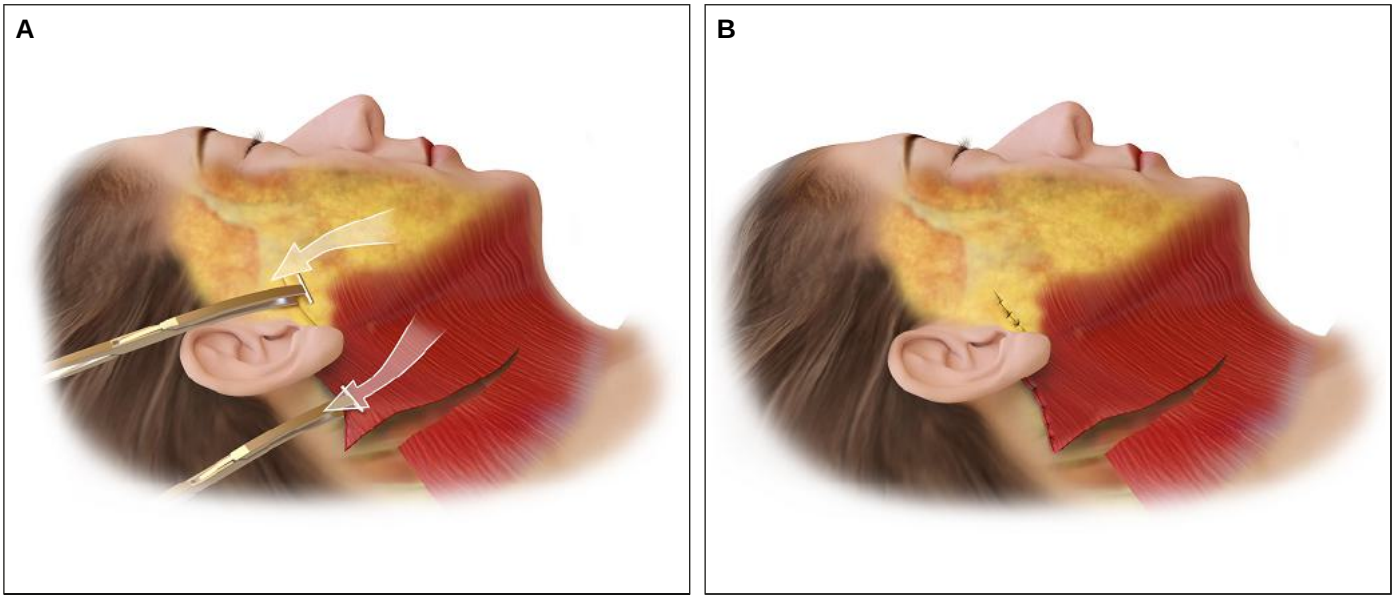

Figure 7. (A, B) Sequence of the complementary platysmal strap to define the mandibular branch and the submental area. (A) Traction vector. (B) Final position of platysma muscle.

Postoperative Period

The main postoperative complications of facial surgery were evaluated, such as paresis, parotid fistula, minor (nonsurgical) hematomas, hematoma expansions, late hematoma expansions (requiring surgical approach), seroma, infection/necrosis, and perioperative dehiscence. Complications were evaluated and documented in each patient's medical records during routine postoperative return visits.

RESULTS

The Full SMAS can help to achieve natural results and high patient satisfaction, as assessed by feedback from patients during clinical evaluation in the postoperative period. Figures 8-11 show the postoperative results in 4 patients 1 year after being treated by the Full SMAS approach. Of the 161 patients analyzed, 145 were female and 16 were male; patient ages ranged from 38 to 74 years (mean, 57 years). The average surgical time was 4.57 hours.

None of the 161 patients analyzed reported any irreversible alterations, such as skin flap necrosis or definitive paresis. Moreover, 145 patients (90.08%) reported no postoperative complications (Table 1). The few postoperative complications reported by 10 patients (6.2%) were reversible. There was 1 case (0.62%) of minor dehiscence in a patient with a history of smoking; 1 case (0.62%) of a parotid fistula, confirmed by amylase measurement, which fully recovered after 7 days; 2 cases (1.24%) of minor hematomas, with recovery by puncture in an outpatient care system, were reported in patients who did not follow the postoperative rest guidelines; and 1 case (0.62%) of late hematoma expansion at 7 days postoperative was reported in a hypertensive patient due to cocaine use. One case (0.62%) of infection in the border of the retroauricular cutaneous flap was also observed. There were 5 cases (3.1%) of temporary paralysis, 3 affecting the marginal mandibular branch and 2 the temporal branch. They all resolved within 4 to 8 weeks. Five cases (3.10%) of seroma were observed in patients who needed larger flap detachments in the cervical region than others.

DISCUSSION

We believe that the effectiveness of cosmetic surgery and the obtention of natural results that surgeons and patients so strongly desire require treatment of all regions of the face.[2] Therefore, none of the changes related to aging in any facial regions should be ignored. Despite this, the frontal-orbital region is often neglected due to the sequelae of scarring, the complexity of available techniques, and the lack of long-lasting results.[1,2]

The most common techniques use traction of the muscle layer,[2,10,14,16] with or without an aponeurotic muscle flap elevation, which should be considered depending on the indication of each case. For faces with marked bone edges, mild ptosis of deep structures, and good mandibular definition, we suggest SMASsectomy[5] and plication are indicated.[17] For most cases, a flap of SMAS-platysma of variable extension, with the release of the true retaining ligaments of the face, should be considered.

We believe that the most effective, natural, and lasting treatment should raise the face vertically and consider all facial parts as a whole.[1,2,13] Few techniques allow for frontotemporal and anterior midface sub-SMAS-platysma detachment, with a safe detachment of the orbital and zygomatic ligaments. Perhaps the only techniques that allow effective and direct visualization treatments are the bicoronal approach and video-assisted surgery.[1,14] The relevant difference between these techniques is that video-assisted surgery produces practically no scars and little alteration in sensitivity, as well as visualizing the small structures of the face with a magnification of 10×, providing security during dissection and predictability of long-term results.[1,14] Bicoronal frontal lift surgery, on the other hand, leaves extensive scars which are susceptible to alopecia and permanent alterations in sensitivity, conditions that are not acceptable to patients who are candidates for cosmetic surgery.

The frontal region should be treated by the same sub-SMAS approach and ligament detachment as the other facial areas. As Mendelson and Wong discussed, the face and superciliary region repositioning should be compared to a tree.[15] If we only bend the branches, they will return to their previous position with time; but if we pull out the roots—which we can compare to the ligaments—and

Figure 8. Photographs of a 58-year-old female patient preoperatively and 1 year postoperatively following full-SMAS intervention. (A, C, E) Preoperative frontal, oblique and lateral views, respectively; (B, D, F) 1 year postoperative frontal, oblique and lateral views, respectively.

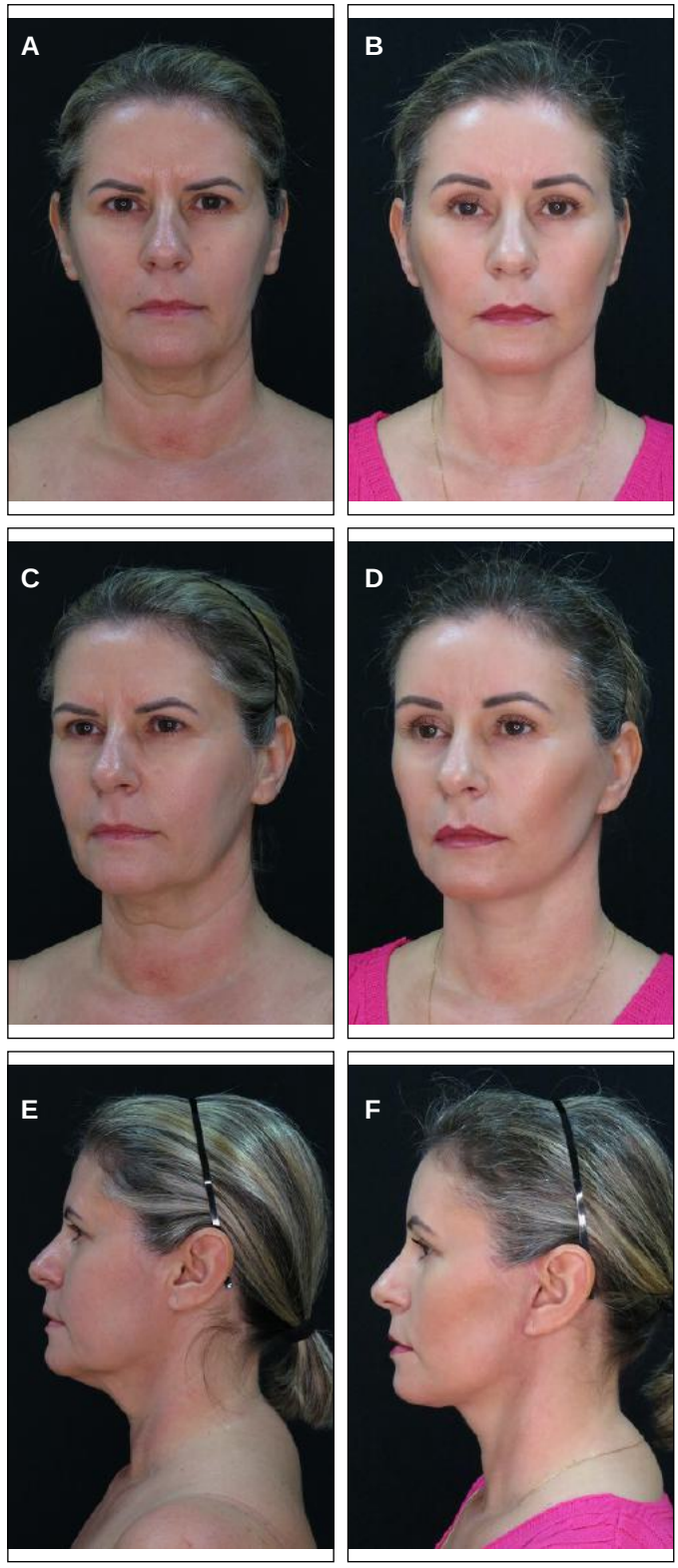

Figure 9. Photographs of a 50-year-old female patient preoperatively and 1 year postoperatively following full-SMAS intervention. (A, C, E) Preoperative frontal, oblique and lateral views, respectively; (B, D, F) 1 year postoperative frontal, oblique and lateral views, respectively.

reposition them, the result will be efficient and long-lasting. The positioning of the superciliary region is given by ligament fixation and supraorbital adhesions. The endoscopic procedure allows a customized detachment and positioning of the superciliary region.[1,14]

The endoscopic approach through a 2-cm temporal portal also allows detachment of the midface and lower periorbital region. The evolution of the endoscopic procedure currently allows release of the masseteric zygomatic ligament and the temporal vertical repositioning

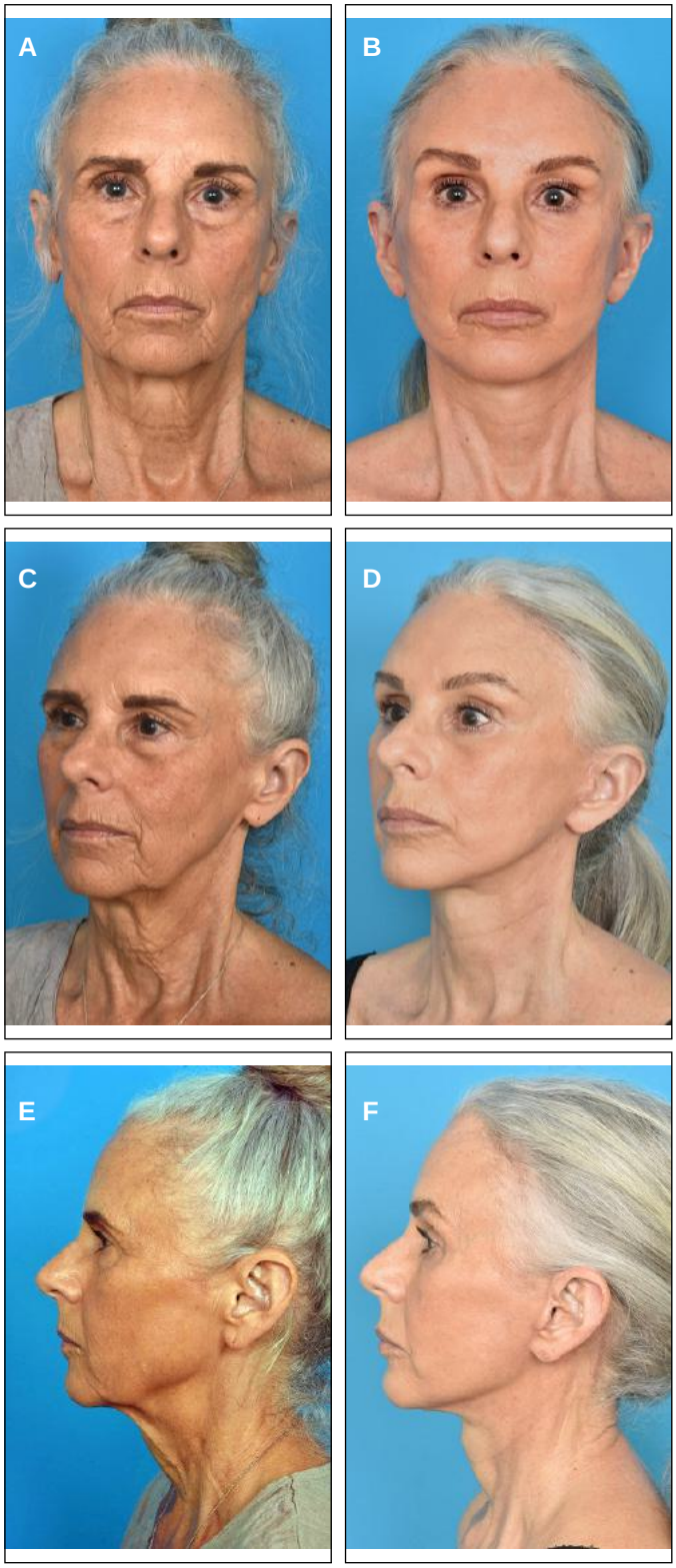

Figure 10. Photographs of a 73-year-old female patient preoperatively and 1 year postoperatively following full-SMAS intervention. (A, C, E) Preoperative frontal, oblique and lateral views, respectively; (B, D, F) 1 year postoperative frontal, oblique and lateral views, respectively.

Figure 11. Photographs of a 68-year-old female patient preoperatively and 1 year postoperatively following full-SMAS intervention. (A, C, E) Preoperative frontal, oblique and lateral views, respectively; (B, D, F) 1 year postoperative frontal, oblique and lateral views, respectively.

of the entire midface—that is, the Full SMAS technique. There is also the possibility of using the current endoscopic approach alone in cases with no cervical flaccidity, improving the ptosis of the superior and midface regions without the need for an open facelift.[1,13,14]

After more than 29 years of utilizing endoscopic techniques in facial rejuvenation, we feel confident that our approach has improved surgical outcomes and expedited postoperative recovery. Full SMAS combines some already-known procedures with video surgery, allowing fewer

Table 1. Postoperative Complication Rates of the Full SMAS Technique

Postoperative complications	Number of patients	Percentage (%)
None	145	90.08
Temporary paralysis	5	3.10
Seroma	5	3.10
Minor hematomas (nonsurgical)	2	1.24
Late hematoma expansions	1	0.62
Parotid fistula	1	0.62
Infection	1	0.62
Dehiscence	1	0.62
Flap necrosis	0	0
Total	161	100

displacements and reducing scars at the middle and lower parts of the face.[17] The 2 most important concepts observed in our review are: (1) the change of the dissection plane from the midface to the supraperiosteal —a plane that continues laterally to the premasseteric space and inferiorly to the oral space, allowing the release of the zygomatic masseteric ligament and the reduction of postoperative edema; (2) the endoscopic magnified dissection allows easy visualization and reliable discrimination of the temporal, orbital, and zygomatic ligaments. The philosophy of the Full SMAS treatment is to approach the sub-SMAS-platysma from temporal, frontal, and lower cervical regions in a single plane.[1]

The controversial question of whether or not to open the submental region is always a matter of discussion among facial aesthetic surgeons. We utilize the submental approach in 80% of our cases. This approach improves the cervical-mandibular angle, especially in patients whose jawline is poorly defined due to the projection of subplatysmal fat and in cases of very strong platysmal bands.[1]

In addition, using the internal circular hemostatic net[1] practically eliminated hematoma expansions in the immediate postoperative period. In this study, we observed only 1 large hematoma that required reintervention. This patient had a history of bleeding during previous surgery. Two other patients showed very small hematomas that were aspirated in the clinic with no further complications. There were no cases of definitive paralysis. There was 1 temporary marginal mandibular paralysis, probably caused by liposuction performed during the procedure, which resolved in 8 weeks.

One of the senior authors does not utilize any internal or external hemostatic network and prefers the use of fibrin adhesives/glues as a lymphatic sealant and for internal soft tissue hemostasis. That reduces intraoperative time, promotes early adherence of soft tissue lawyers delaminated during the procedure, eliminates postoperative bruising, and eliminates the use of drains almost completely.[18-22]

Although some patients do not wish to undergo this global facial rejuvenation approach due to some particular desires or doubts about the procedure, financial constraints are not a limitation. The Full SMAS is not necessarily more expensive than conventional lifting. The main limitations for applying the technique are related to patients who have already had surgical treatment of the upper third or who do not have superciliary ptosis or are satisfied with the upper third of their faces.

Although our study did not include an objective measurement scale of our results, the follow-up of 161 patients allowed us to determine patient satisfaction and detect better results than those observed after years of experience with other surgical techniques. Therefore, further studies, including objective measurements of results, may help to standardize and establish the Full SMAS as a typical procedure for total facial rejuvenation.

CONCLUSIONS

The Full SMAS is a systematic technique that provides complete facial rejuvenation by combining an endoscopic approach for the temporal and midface regions with traditional open approaches for the lower face and neck. By releasing key ligaments and adhesions using the endoscope, this technique allows vertical repositioning of the entire midface in continuity with the periorbital and temporal regions. When associated with open approaches to the lower face and neck lift, it provides natural results in all facial regions, reduces the probability of nerve injury and tissue damage, and reduces recovery time, producing effective and predictable long-term results.

Supplemental Material

This article contains supplemental material located online at https://doi.org/10.1093/asj/sjae177.

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Commentary

Commentary on: Practice Patterns: An American Society of Plastic Surgeons (ASPS) Member Survey, 2000 and 2020—How Much Has Browlifting Changed?

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The authors have taken on the task of updating, for the first time since 2001, a survey of the American Society of Plastic Surgeons (ASPS) membership regarding upper facial rejuvenation and browlift practice patterns.[1] The authors recently published a survey of facelift procedures among the same demographic group of surgeons and found that although the basic approach to facelifting has not changed much, there have been a number of significant changes, mainly in terms of ancillary procedures including fat grafting techniques, simultaneous skin resurfacing, and the use of hemostatic agents such as tranexamic acid.[2] This report is the second part of their survey and specifically addresses practice patterns in the upper face. They include their results and their postulations as to the reasons for any changes, and then compare their findings with recent literature.[3]

Although the survey was intended to replicate and thus compare with the 2001 survey, and it may have selected out primarily experienced surgeons who practice frequent facial aesthetic surgery, I feel it would have been even more informative had the authors actually limited the survey to those surgeons with the most experience in that field. Also, the response rate was low (11%) and only 257 surgeons responded, half the number in the 2001 survey.

Nonetheless, there are pertinent data here for us to examine because over 73% of the surgeons had been in practice for over 20 years, and 65% were in solo private practice. Respondents indicated they had performed an average of 9.5 open browlifts (range, 0-60) and 8.3 closed browlifts (range, 0-100) over the previous 12 months. This has changed from the 2001 survey values of 8.1 and 9.3, respectively, indicating a shift, albeit modest, back toward open lifts in terms of frequency, yet with at least 1 surgeon performing 100 endoscopic browlifts per year. Unfortunately, the survey did not include the gliding lift, most likely because it was introduced more recently and thus has not had time to enter widespread use, although it remains to be seen if that will be the case.[4]

Interestingly, the survey shows that the percentages of surgeons practicing various techniques did not correspond to their opinions regarding efficacy in lifting the brows, and correcting forehead and glabellar lines, nor did their responses regarding efficacy correlate with the consensus in the current literature. With regard to choice of procedure for lifting the brows, 28.32% of respondents listed the closed endoscopic approach, followed by 22.5% lateral subcutaneous/temporal techniques, 21.4% hairline/pretrichial (modified coronal), 12.1% coronal, 8.7% chemical (neuromodulators), 4.6% transpalpebral, and 2.3% direct (eyebrow). The respondents defined all but the endoscopic

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group as "open" approaches, which therefore accounted for 77.5% of procedures performed.

Not surprisingly, based on these opinions on the efficacy of correcting brow ptosis, most respondents felt that the open approaches (more specifically, hairline browlifts and coronal) were more effective by a wide margin, 42% vs 7.4%. However, among all the various techniques reported, both open and closed, the most frequent technique employed for the correction of brow ptosis in both surveys was the endoscopic approach.

When they were queried about effectiveness for "fully" eliminating transverse forehead lines, respondents still felt that the open technique was more effective than the closed (13% vs 1.1% closed), and similarly for lateral open lifts; for glabellar corrugator lines, the difference was 14% vs 5%, respectively.

The above discrepancy between opinion regarding efficacy vs technique employed is most likely multifactorial and probably corresponds to the aversion of both patients and surgeons to leaving visible scars since far more closed techniques were utilized than the opinions would have predicted.

In addition, the question presented in the survey asked if the technique "fully" corrected transverse lines or glabellar frown lines as opposed to a level of improvement, or related it to patient satisfaction, both of which can be quite different and may drive procedure selection. For example, when the same question was asked about neuromoulators, only 17% of respondents stated that these "fully" corrected transverse forehead lines, and only 33% stated they fully corrected glabellar lines, yet over 88% of current respondents reported using neuromodulators frequently as an alternative to brow lifting in order to address glabellar/corrugator frown lines. Thus, the satisfaction of patients with treatments, surgical or nonsurgical, clearly may not correlate with surgeons' opinions regarding "fully" correcting a situation, otherwise neuromodulators, as well as various surgical techniques, especially the endoscopic approach, would not be utilized as frequently as they are. Personally, I do not believe neuromodulators "fully" correct forehead lines at all, yet I use them all the time to improve these lines. Thus, the wording of the question as to "fully correcting" may have played a role in the outcome data.

In terms of ancillary procedures, we admit we were quite surprised to see the reduction in laser resurfacing (from 24.4% down to 10.1%)—considering the advances in laser technology over the past 20 years—as we use it in 80% of our cases. No doubt this was also related to patient concerns about downtime and the perception of pain and/or appearance immediately after treatment. The authors note that neuromodulators have surpassed lasers in terms of being the most frequently performed ancillary procedure.

It was most interesting to see the discrepancy between the respondents' opinions and recent reports in the literature which the authors point out. More recent literature has clearly established the efficacy and long-term results of the endoscopy-assisted closed approach as being equivalent to open techniques,[5-8] yet most of the surgeons queried do not agree. Reasons for this could be multifactorial. Most of the surgeons queried were older and thus most likely to have never trained in endoscopic techniques, and/or perhaps tried these and were frustrated. Proper training is essential to success with endoscopy even with experienced surgeons. Furthermore, educational program bias at national meetings could play a role as we have seen many panels over recent years with little to no input from those expert in endoscopy—and even panels that were hostile to the procedure—even though 28.32% of these surgeons use it as their primary procedure. Also, similar to endoscopic breast augmentation, many surgeons just do not wish to learn to use the equipment or buy it when they are comfortable with older techniques even though these leave visible scars on the chest, or in this case, the forehead. Furthermore, those reporting on the technique in the literature are more likely to have the expert capability required for success. And finally, endoscopy is not often taught in plastic surgery residency training as it is in otolaryngology, so a majority of graduating residents have little to no exposure to the technique as confirmed by those who interview for endorsed aesthetic fellowship positions. It would be interesting to see this same survey administered to plastic surgeons and facial plastic surgeons matriculating through otolaryngology residency where endoscopy is taught as a fundamental skill.

The authors conclude that there has been a decided shift toward less invasive procedures such as the endoscopic, lateral subcutaneous, and chemical browlift with botulinum toxin. They postulate that patient perception may play a role in this. The modern patient now seeks improvement with less-invasive procedures, less downtime, and no evidence of telltale scars. It is noteworthy that the survey indicates the number of browlifts has not decreased among those who regularly practice aesthetic surgery as opposed to the ASPS data published, so the procedure remains very relevant for today's surgeons although practice patterns and opinions have changed.[9] The authors also state that nearly 30% of today's surgeons feel neuromodulators have replaced surgical browlifting to a large degree, yet the fact that the surgeons in this survey report no decrease in the number of procedures seems to contradict that finding.

The absence of a predominant technique or opinion indicates the continued divisiveness among aesthetic surgeons regarding management of the forehead and brow, and we still have a lot to learn regarding effective management in the upper face. The authors believe that with the focus having shifted towards less-invasive procedures and less downtime, and with the aesthetic focus shifting towards brow shaping, coupled with the advent of regenerative technology based

on nanofat and exosomes,[10] we will no doubt see further changes in how we approach the upper face. I commend the authors for completing this extensive survey, which has given us important information.

Disclosures

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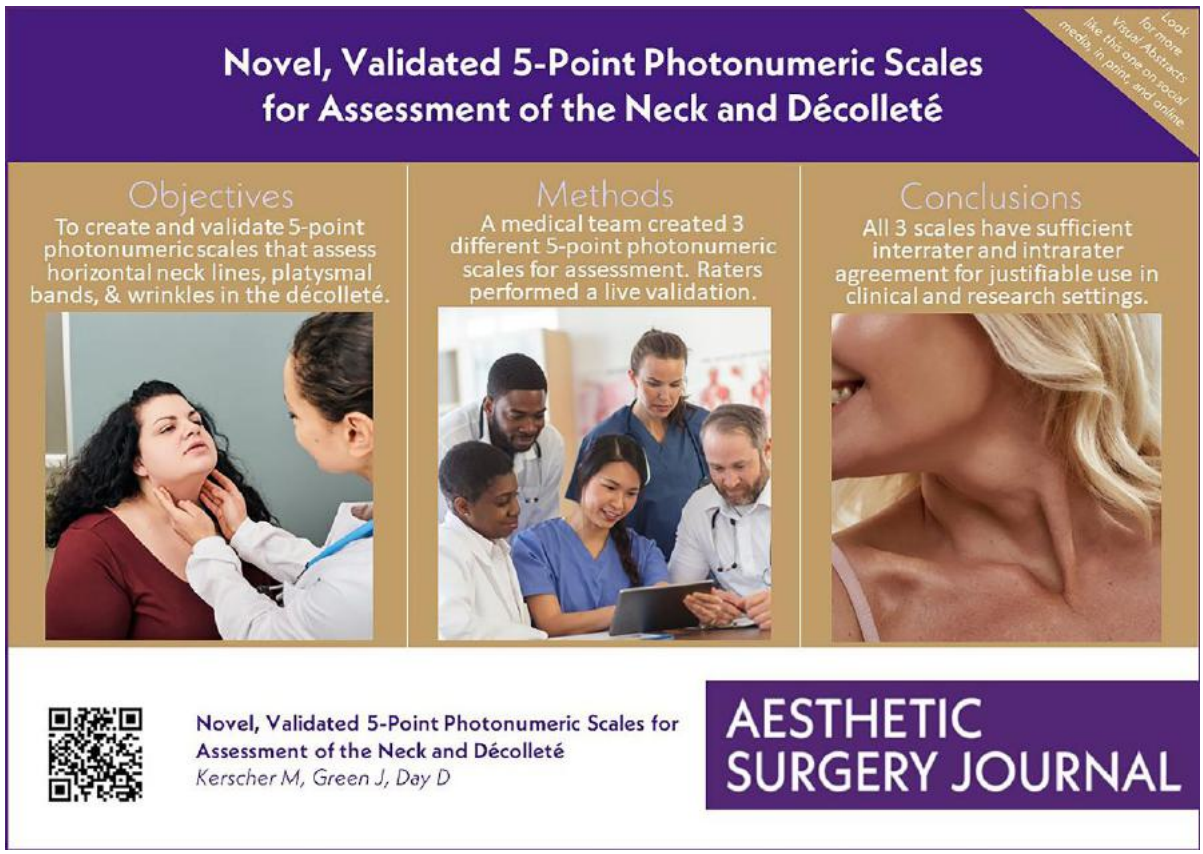

MINIMALLY INVASIVE TECHNIQUES IN
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ENDOSCOPIC BROWLIFT

Grady B. Core, MD, Luis O. Vasconez, MD,
and H. Devon Graham III, MD

In 1990, a research effort at the University of Alabama at Birmingham was begun to explore the possible applications of endoscopic techniques to plastic and reconstructive surgery. It was our hypothesis that endoscopic techniques would help avoid sequelae associated with long incisions used to achieve aesthetic goals. Owing to the wide scope of possible procedures, we initially began in the face and later explored the abdomen, breast, and other areas. This research effort is still ongoing as it is now at other institutions. Our initial clinical experience in endoscopy was presented at the fall meeting of the American Society of Plastic and Reconstructive Surgeons (ASPRS) in 1992.[3] Since that first report, there has been rapidly increasing interest by others in this technique for many types of aesthetic surgery.[1, 4–12, 14] This article presents the development and current status of endoscopic browlifting from its inception at the University of Alabama at Birmingham (UAB) to its current technique as it is now practiced at UAB and the Ochsner Clinic (OC). The OC experience began in July of 1992 as a direct result of the relocation of one of the authors (GBC). The speed at which other innovative surgeons subsequently have developed variations in the technique of endoscopic browlifting has been quite rapid.

MATERIALS AND METHODS

Basic Research

This project began with the investigators taking a full certification course in orthopedic arthroscopy. We then progressed on to actual development of surgical techniques in human cadavers. In order to meet our needs, and, as no specialized instruments were available for this procedure, we developed our own instruments that were designed and produced "in-house" at UAB in 1991. These instruments have served as the prototype for many subsequent endoscopic facial elevators and dissectors after appearing in a video presentation at the fall meeting of the ASPRS in 1992. Additional unique instruments were later developed by other investigators to perform a wide variety of maneuvers to suit the needs of a particular technique. We also have subsequently developed more specialized instrumentation in association with a leading manufacturer of endoscopic equipment (Smith & Nephew Richards, Inc, Bartlett, TN). For a complete presentation on specific instruments and their uses, please refer to the article by Eaves et al in this issue on basic setup and instrumentation.

As a result of the cadaver dissections, we

From the Ochsner Clinic (GBC, HDG) and Tulane University School of Medicine (GBC, HDG), New Orleans, Louisiana; and the University of Alabama at Birmingham, Birmingham, Alabama (LOV)

quickly realized the need to develop an "optic cavity" in order to visualize the procedure. Methods for maintaining this optic cavity in soft-tissue planes also were investigated with new designs in various retractors and elevators, both internal and external to the skin. After extensive cadaver dissections and collaborations with colleagues in other specialties, we embarked upon clinical cases in early 1992. Initially, these were browlifts done entirely endoscopically using rigid endoscopes via a closed approach. We soon included orbital fracture exploration, abdominoplasty, breast augmentation, and facelifting.

Clinical Research

Browlifting was selected as the initial procedure because an optic cavity is best maintained when there is a bone-to-soft tissue interface, and we believed the results would be more predictable. Since then, we have performed 150 cases of endoscopic browlifting (100 at UAB; 50 at OC).

Prior to undergoing the procedure, all patients were selected based on whether or not they had one or more of the known surgical indications for the open browlift procedure, namely brow ptosis, deep transverse horizontal rhytids, or deep glabellar frown lines.[13] In addition, we have included three patients with unilateral facial paralysis who required unilateral brow elevation for symmetry.

We did not consider patients with high foreheads as candidates early in the series; however, we now feel these patients are acceptable for the biplanar technique.[11] The biplanar technique is covered in the articles by Oslin et al and by Ramirez elsewhere in this issue. All patients were instructed as to the fact that the procedure involved new technology to help us obtain our surgical goals. Informed consent was obtained not only for the endoscopic browlift but also for the open technique in case we were unable to achieve our goals endoscopically. No cases had to be converted to the open technique to achieve our surgical goals. Procedures were performed either under general anesthesia or under local anesthesia with heavy sedation. Complications were minimal and are covered later in this article.

Endoscopic equipment was supplied by Smith & Nephew Richards, Inc, and consisted of endoscopic elevators and tissue dissectors, retractors, knives, scissors, and suction irrigation handles for the endoscopes. The endoscopes supplied were sinus endoscopes, 4 mm and 5 mm, with 0- and 30-deg lens angles.

DESCRIPTION OF PROCEDURE

The technique of endoscopic browlift is very similar among the three authors; however, some minor variations have developed between the two institutions. Variations practiced at one institution only will be followed by the initials of that institution (UAB or OC). Otherwise, the reader should assume that both institutions practice the same technique.

The patient should be placed on the operating table such that the surgeon has full access to the entire area about the head, and the video monitors should be placed at the foot of the bed in the surgeon's line of vision. The operating table should be one that can be changed easily from a supine position to an erect position because of the need to evaluate the symmetry of the eyebrows later in the procedure with the patient in a sitting position. If general anesthesia is selected, the endotracheal tube should be directed distally with a clear plastic sterile drape enveloping the tube and with the anesthesiologist to the side at the level of the thighs.

The position of the supraorbital and supratrochlear nerves can be identified with a marking pen, with the supraorbital nerve being approximately 2.4 cm from the midline and the supratrochlear nerves being approximately 1.6 cm from the midline. A 3-0 silk suture is placed in the skin over these for later retraction of the skin over the nerve. Preoperatively, measurements also are taken from the level of the medial canthus to the medial brow level and to the lateral brow level as well as from the midpupil to the midbrow to determine the amount of elevation obtained later. After infiltration of both brow areas and the proposed incision sites (ports) with 2 mL of 1% lidocaine with epinephrine 1:200,000, the incisions are made 1 cm above the hairline with the number of incisions ranging from three to five (Fig. 1). If a plate fixation technique is intended (OC), another incision is made centrally and posteriorly at the vertex of the skull. The incisions above the hairline may be oriented vertically or horizontally, or a small wedge of skin may be removed to create an advancement technique. At the present time, one author uses

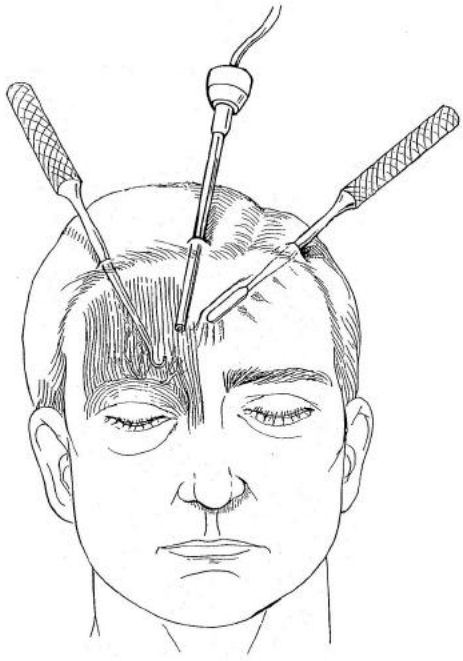

Figure 1. Incisions with placement of endoscope initially.

the skin resection technique (LOV), another author uses 1-cm vertically oriented incisions (GBC), and the other author uses 1-cm transverse incisions (HDG). After the incisions are made, the dissection is carried subperiosteally in a blind fashion down over the forehead to within 1 cm of the supraorbital ridge. The endoscope (rigid, 4 mm, 30 deg) then is placed through the central port and the field is visualized. Initially, one should see periosteum adherent to the frontal bone (Fig. 2, see color plate) in the central areas of the forehead. The remaining portion of the dissection is carried out under direct endoscopic control. The lateral portion of the dissection will reveal a transition zone between the periosteum and the deep temporal fascia. This transition zone is a difficult area to dissect, as there is a point of fusion between the deep temporal fascia, superficial temporal fascia, the periosteum, and galea. There has been some confusion over the proper names of these fascial layers (Fig. 3).[15] The lateral dissection is performed by incising the skin and superficial temporal fascia in the temporal region (Fig. 4) down to the level of the deep temporal fascia. Blunt dissection then is carried out over the deep temporal fascia using a curved elevator and endoscopic control. This dissection is extended caudally toward the zygoma and continues in a natural plane from just above the temporal fascia out onto the superficial layer of the deep temporal fascia (intermediate fascia). A superficial fat pad is encountered lateral to the plane of dissection (above the elevator) in the loose areolar tissue. Another fat pad is seen lying below the intermediate temporal fascia. A sentinel vein, very constant in size and location, also can be seen anteriorly in the loose areolar layer toward the orbital rim at the level of the zygomaticofrontal suture line. This vein should be cauterized and divided if a significant degree of lateral lift is desired, with the dissection extending further anteriorly and caudally toward the orbital rim and zygoma. Dissection in this area should be delicate because of the close proximity of the frontal branch of the facial nerve. If the endoscopic browlift is to be performed in combination with a pre-hairline facelifting technique (UAB), this extent of lateral dissection will be unnecessary, as the pre-hairline skin lift will provide the vertical lift necessary to take care of any crow's feet. If no facelift is planned, however, this lateral dissection is necessary to allow the skin over the temporal region to be lifted. Extension of this dissection into the midface is discussed in the article by Ramirez elsewhere in this issue.

After the lateral pocket has been developed, the tough fascial partition between the lateral pocket and central pocket is divided. The endoscope is placed in the central pocket with a retractor-elevator. A dissecting elevator is placed in the temporal pocket and is used to push through the base of this partition where it attaches to the skull. The elevator can be seen entering the central pocket endoscopically (Fig. 5). The partition, which attaches to the skull at the temporal line, then is divided from posterior to anterior toward the orbital rim using the elevator.

After dissection has been completed laterally, the endoscope then is placed back into the central port with the elevators in the adjacent lateral portals. Endoscopic visualization then is used to dissect the supraorbital and supratrochlear nerves from the surrounding tissue at the subperiosteal level. Release of the periosteum from the orbital rim is performed medial and lateral to these nerves. Most of the dissection thus far can be carried out with sharp or blunt periosteal elevators. For dissection around the nerves, however, blunt instruments should be used either in the form of elevators or nerve hooks. The nerve hook can help skeletonize the nerves from surrounding tissue (Fig. 6). Blunt dissec-

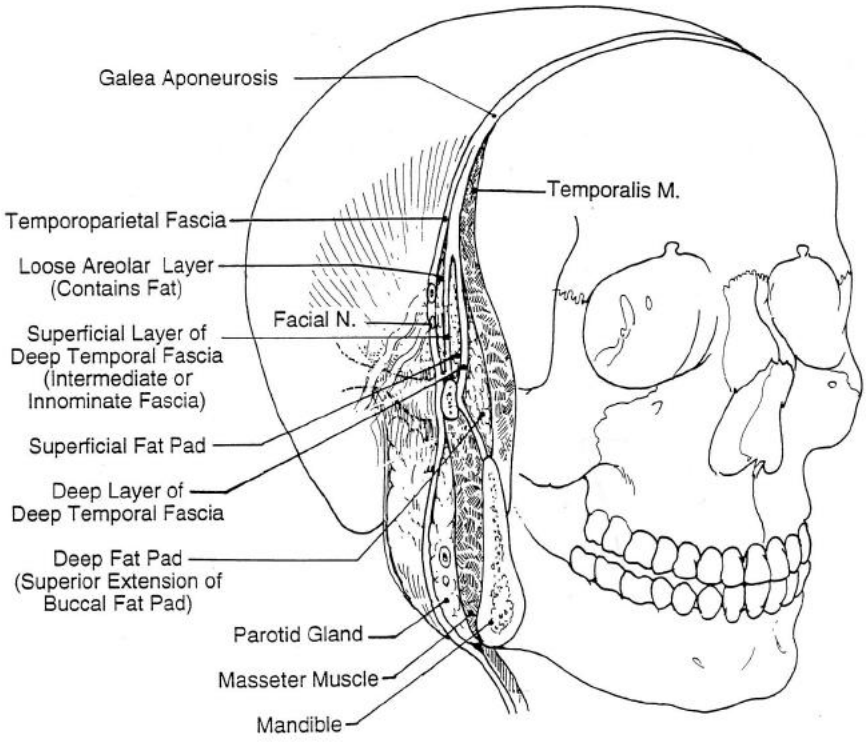

Figure 3. Anatomic drawing of temporal fascial layers.

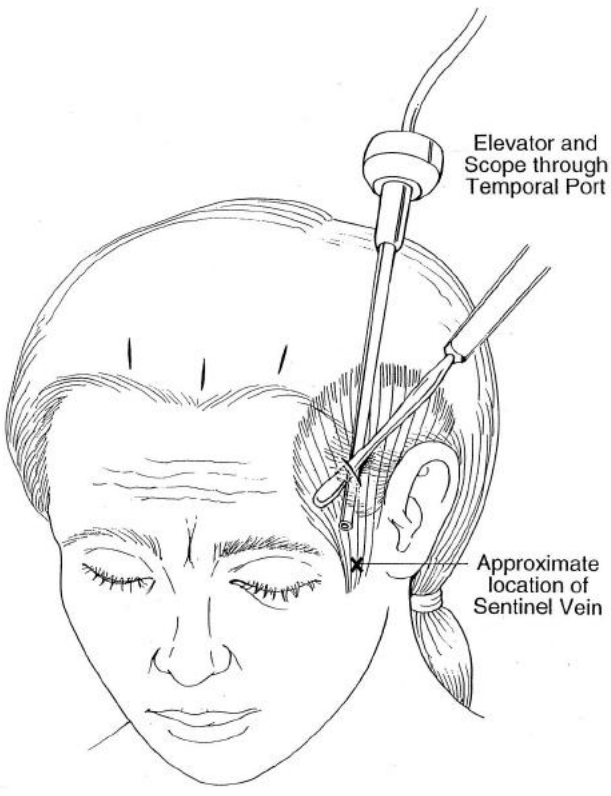

Figure 4. Lateral ports and dissection.

Figure 2. Initial view in forehead via endoscope.

Figure 5. Elevator entering central pocket from temporal pocket at temporal line.

Figure 6. Supraorbital nerve.

tion with endoscopic scissors also can be used for this purpose. At this point, one will begin to see the relationships of the supraorbital nerve, supratrochlear nerve, and corrugator muscles. Extension of the forehead dissection down onto the nasal dorsum also can be performed, which can aid in the resection of the procerus muscle if indicated. This dissection also can be used in conjunction with a rhinoplasty procedure (UAB). After the forehead is widely elevated (Fig. 7) and all periosteal attachments divided as described, one will notice that the brows are already elevated because of the release of the periosteal attachments and the retraction of the skin and frontalis muscle. Depending on the preoperative indications, the procedure then may take one of several directions. For patients with deep transverse wrinkles of the forehead, the frontalis muscle can be weakened with endoscopic knives in a fashion similar to that described for the open technique.[13] We do not recommend the use of electrocautery for this technique, as we have had one case of transdermal thermal injury. A transcutaneous burn may not be readily appreciable at the time of the initial injury only to progress to skin necrosis in the postoperative period. If the corrugator muscles need to be addressed in order to improve the glabellar frown lines, then we perform resection of the corrugator muscles, sparing the supraorbital and supratrochlear nerves. The procerus muscle may need thinning or partial resection but care should be taken to avoid over-resection, as a depression can be created in the central forehead. For management of brow ptosis, our techniques differ somewhat based on whether or not a method of fixation of the soft tissue to the bone is used. If one uses a technique where fixation is not used (UAB), the brow simply is lifted into the desired position and taped into position (Fig. 8). Some further elevation, however, is achieved through taking out skin at the incision site and advancing the skin upward. If one chooses a fixation technique (OC), however, we recommend one of permanent fixation using titanium miniplates. The rationale behind this approach is as follows. First of all, we feel this allows a higher degree of accuracy and control because the brows are lifted into the exact desired position and are fixed with the patient in a sitting position. We strategically identify specific areas that are in need of various degrees of elevation. We are able to apply exact vectors of lift by placing permanent 2-0 nylon suture through the deep tissue (galea/frontalis) in an area that is strategically identified in need of elevation. The point of placement of the suture is in the deep tissue immediately anterior to the endoscopic portals. The suture then is passed through a hole in a T-shaped titanium miniplate (Leibinger Inc, Dallas, TX) (Fig. 9). The hole in the miniplate has been bored out with a microdrill to create blunt inner surfaces that will prevent suture cutting. After several sutures are passed from the deep tissues to the holes in the plate, the proper amount of tension is placed on the sutures to elevate the soft tissue into the exact desired position. We feel this eliminates overlifting of the brows as has been noted in some endoscopic forehead series. It also allows adjustment on the table until symmetry is perfect. In addition, varied directional vectors of pull can be used by adding screws at strategic sites, around which the elevating suture is passed en-route to the plate. Thus, all vectors of pull do not necessarily have to point toward the plate. Based on some reports of early recurrence,[14] we feel that a permanent type of fixation will eliminate any recurrence of brow ptosis. Others have argued against introducing "permanent material," such as titanium plates, into aesthetic surgery patients and we feel that these arguments are contradictory as some of these same surgeons frequently place permanent implants in the face and other regions of the body of these and other aesthetic surgery patients. In addition, the track record of tita-

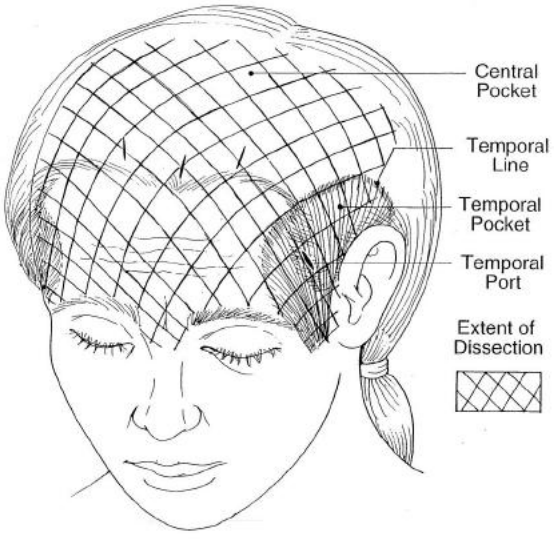

Figure 7. Extent of completed dissection.

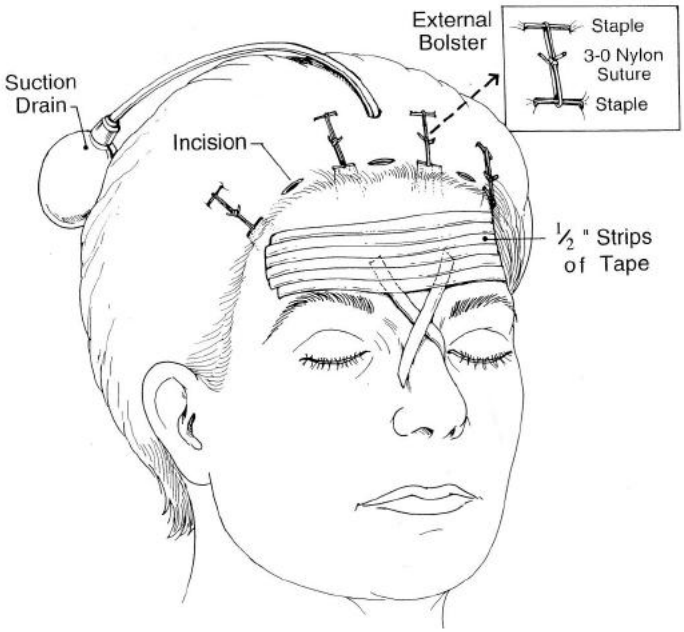

Figure 8. Taping of forehead.

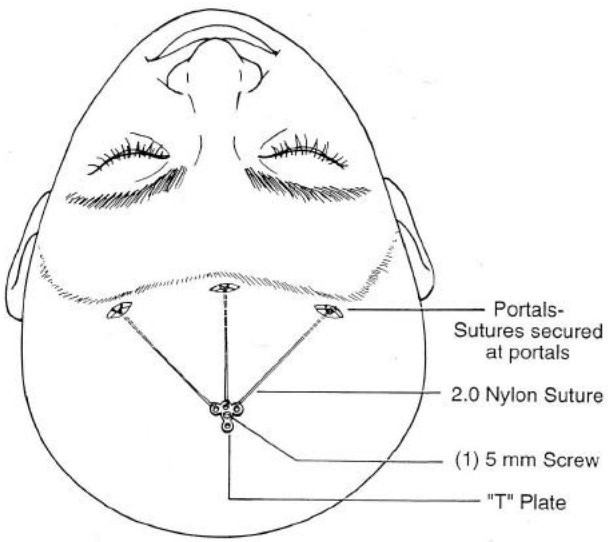

Figure 9. Miniplate fixation system.

nium miniplates in the management of facial trauma is outstanding with regard to biocompatibility.[2] We have found that aesthetic surgery patients have not had any problems with the use of permanent suture or small, flat titanium miniplates and screws that are not palpable through the scalp. If, in fact, the titanium miniplate or screw were to give the patient a problem in the future or if the patient for some reason not related to a true complication desired their removal, it would be a simple procedure under local anesthesia to remove them.

Despite whether fixation is used or not, once the brow is fixed into position, a small drain may be placed (UAB). A compression bandage with a wrap is then put in place. We recommend that any concomitant blepharoplasty, if planned, be performed after the browlift because, many times, the browlift will take up much of the excess skin in the upper lid.

CLINICAL CASES

Case 1 (OC)

This case is representative of a patient with very straightforward indications for endoscopic browlift, namely, brow ptosis with forehead wrinkling. Preoperative photographs on this patient are noted in Figure 10*A*. The operative plan calls for dissection over the entire fronto-orbital region and laterally for the correction of crow's feet and lateral brow ptosis as well. An SMAS facelift also was planned. The brows were fixed using the miniplate fixation system. Postoperative results demonstrate smooth forehead and brows appropriately elevated with no overlifting or asymmetry. Follow-up at 1 year reveals no evidence of recurrent brow ptosis (Fig. 10*B*).

Case 2 (UAB)

This case (Fig. 11) is another example of straightforward browlifting with the endoscope. A facelift with malar fat pad elevation also was performed. Fixation was not used.

Case 3 (OC)

This patient (Fig. 12) presented with asymmetry caused by facial nerve paralysis. A unilateral endoscopic browlift was performed to

Figure 10. *A*, Preoperative appearance of patient with brow ptosis and forehead wrinkling. *B*, Postoperative results after endoscopic browlift and miniplate fixation at 3 weeks.

Figure 11. *A* and *B*, Preoperative views of a 43-year-old woman who requested facial rejuvenation. *C* and *D*, Postoperative views (6 months) following endoscopic browlift as well as facelift with malar fat pad elevation.

Figure 12. *A,* Preoperative appearance with brow asymmetry. *B,* Preoperative lateral view. *C,* Postoperative view with elevation of left brow. *D,* Postoperative lateral view with improvement of hooding. No blepharoplasty was performed.

Figure 13. *A,* Preoperative appearance of patient with brow asymmetry and bilateral ptosis. *B,* Postoperative appearance (3 months) after endoscopic brow and midface lift. No upper lid blepharoplasty was performed. (Patient has orbital rim asymmetry.) An SMAS facelift was performed for lower face and neck through preauricular incisions.

Figure 14. *A,* Preoperative appearance of a man with bilateral brow ptosis and malar bags. *B,* Postoperative appearance at 3 months. Upper and lower lid blepharoplasties were performed in conjunction with endoscopic browlifting.

correct this. She had undergone prior open browlift with less than optimal results.

Case 4 (OC)

This patient (Fig. 13) requested brow elevation as well as a facelift. Extension of the dissection into the midface with elevation of the malar fat pads were performed—all endoscopically. SMAS plication also was completed through preauricular incisions. No upper lid blepharoplasty was performed.

Case 5 (OC)

Endoscopic browlifting is applicable to male patients even with some degree of balding. This patient presented with significant brow ptosis and malar bags. He underwent endoscopic browlifting with upper and lower lid blepharoplasties (Fig. 14).

RESULTS

Patient satisfaction with the procedure was high. Complications from 150 cases included hematoma (1), skin dimpling (2), suture extrusion (1), full-thickness burn to forehead skin (1), transient facial nerve paralysis (1), asymmetry (3), inadequate corrugator resection (2), and pain at fixation site (1). A comparative study of the early experience regarding complication rates among surgeons practicing the endoscopic technique and the open technique shows no difference in overall complication rates but a difference in "type" of complications.[14] Further elaboration on the complications, we believe, is necessary to help others avoid these pitfalls; therefore, later in this issue, we have included an article on complications for all types of endoscopic aesthetic surgery.

SUMMARY

We have presented the development and current status of endoscopic browlifting from its inception at UAB to the present techniques as they are now practiced by the authors. Endoscopic browlifting was based on sound preclinical research and included thorough training of all investigators in the use and application of endoscopic equipment. We believe that endoscopic browlifting represents clear advantages over the open technique in selected patients. These advantages included avoidance of the long transverse incision and its secondary sequelae. Improved magnification and visualization of small structures are also a secondary advantage. Complications are no greater than the open technique and tend to diminish with experience. We feel that endoscopic browlifting will continue to be refined and will find a permanent place among the armamentarium of all aesthetic plastic surgeons.[16]

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Commentary

Commentary on: The K-Wire Fixation Technique for Endoscopic Brow Lift: A Long-Term Follow-Up

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Grady B. Core MD, FACS

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The authors present a 22-year experience with endoscopic brow lift utilizing a K-wire fixation method with their long-term follow-up.[1] The complications reported in 284 patients were minimal, with only 2 patients having hematoma and 5 requiring a secondary unilateral brow correction (1.8%) within 3 months. Follow-up was an average of 6 years and ranged from 3 months to 18 years. The results in the photos presented are excellent in terms of postoperative aesthetics. The focus of the paper is the fixation method and the long-term results it provides. The video of the technique shows a simple method for inserting the K-wire with a unique method of preventing overpenetration of the K-wire into the calvarium. The senior author described this technique in 1998 and has continued to utilize the same method because it is quick, easy, flexible, and reliable in addition to yielding good aesthetic outcomes.[2] The longevity of the technique is implied by the long-term photos provided and the fact that he reports no other revisions for recurrence other than the 1.8% that were all conducted within the first 3 months.

Regarding the specifics of the technique, I do have one criticism and that is the senior author's abdication of endoscopic central brow rejuvenation, which, in our procedure, is the main reason for utilizing the endoscope. If he encountered issues from this dissection in his past experience, he should have reported those issues as a certain percentage of complications, especially because he utilized that as a basis for not conducting the central forehead dissection at all. Regarding the author's characterization that our medial brows always paradoxically ascend with aging, I respectfully disagree. In fact, in a review of the Lambros study he states that the brow fell in 41% of patients and that if they had asked the patients to relax for the photos that even more would have fallen.[3] From our experience, mid-brow aging does not paradoxically elevate the medial brows. Although this may occur in some people, we have found it to be the vast minority. It is not unusual for us to see medial brow ptosis even to the extent that they have a horizontal fold of glabellar skin requiring an added vector of lift centrally (Supplemental Figure 1). What we do not do is extensive muscle resection leaving brow elevators unopposed. If the muscles are in balance, there should be no change other than what is created through the lift alone. Brow muscle modification has been a part of browplasty for many years. Keller was the first to publish an isolated endoscopic-assisted myotomy of the brow (not an endoscopic browlift) when he reported utilizing a KTP laser, with the focus of the publication being the laser.[4] Later, Isse, whose "functional lift" also was not a classic lift, described a series of myotomies utilizing endoscopic vision to create a lifted brow though changing the balance of elevators to depressors.[5] Isse's work further demonstrated that strategic muscle release would result in a change in brow aesthetics over time. With the open procedure, the only

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myotomies performed usually were corrugators and sometimes procerus, and although the periosteum was not usually released because the plane was likely subgaleal, soft tissue connections were extensively released. However, we did not see reports of late problems in this area. So, the question is not whether to address the structures but rather how to address them. The original endoscopic brow lift carried out by our team at the University of Alabama Birmingham mimicked the open procedure in every way but eliminated the long transverse incision over the scalp.[6] The only myotomy performed was the corrugators, and issues with the central region were not noted and have not been in 27 years.[7] So, why do some report such issues? I propose that it is due to overdissection and not just periosteal release.

Although this technique has worked for the author for a long time, I do have a few tips for the readers that may help their endoscopic procedures flow better, especially if they plan to address corrugators.

The author describes conducting the endoscopic portion of the central pocket prior to the temporal area. I have found that a full release of the entire temporal pocket region is best done first, including the temporal line of periosteal adhesion as well as the lateral orbital rim periosteal attachments. This allows the optic cavity in the central forehead to be larger and easier to work in. We also release the forehead subperiosteal space via our anterior hairline incisions as does this author, but in addition, we release the anterior hair-bearing scalp from the hairline posteriorly to the vertex of the skull where our universal fixation point is located. This allows for an even larger optic cavity for endoscopic work. There are a few other technical differences with our techniques, such as temporal incision placement, release of lateral orbital periosteal attachments, and the fact that we conduct the brow lift first before eyelids. His method of marking with the patient supine seems to suffice for avoiding overresection of upper lid skin, but most surgeons recommend doing the brow first.[8] Overall, I like this author's technique as it encompasses the fundamentals necessary for success, which are: (1) appropriate and wide release of all necessary attachments under precise visual control, (2) fixation, and (3) appropriate level and vector of lift.

I agree with the author's criticisms of other fixation methods; however, I am surprised that he removes his fixation as early as the third day but reports no late failures bilaterally. We never utilized external fixation because we were concerned about patient acceptance. Our system consists of an absorbable tack placed centrally in the vertex of the calvarium to which all lifting sutures (2-0 PDS) are run under the scalp depending on the needed vectors of lift. This allows for all the variables the author describes in terms of flexibility but also adds long-term security as well as being invisible (Figure 1).

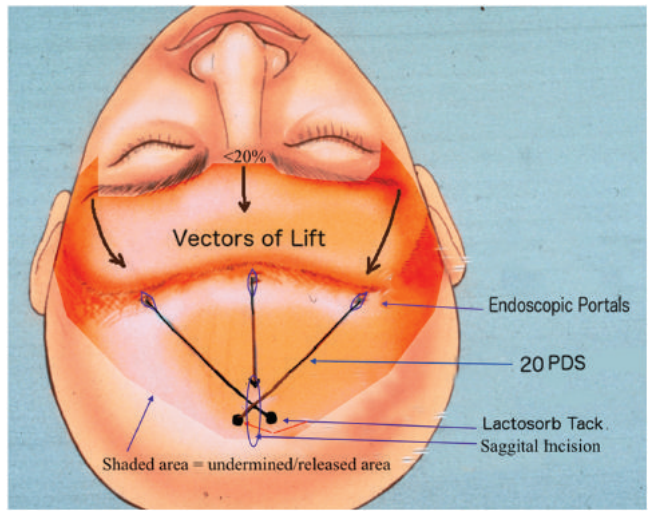

Figure 1. Basic vector endoscopic brow lift showing vectors of lift, extent of necessary release, location of endoscopic portals, and lifting sutures/tacks.

I also agree with the author's diagnosis for the most common cause of early recurrence, which is the lack of full release of all periosteal attachments. The fact that the few revisions he performed were conducted so soon after surgery also points to this as the cause.

There was no mention of operative time in this report, but I feel it is important address this issue because it is frequently cited as a basis for not utilizing an endoscope. For example, in Tabatabai and Spinelli's paper on the "non-endoscopic" brow lift,[9] they stated their endoscopic lift required 50 minutes and their new non-endoscopic lift required 30 minutes. However, by eliminating the endoscopic resection of the corrugators, they were required to add another procedure to address these, which no doubt takes at least 20 minutes. So even in the best of hands, their overall operative time was either approximately the same or likely even longer adding the time for the two together, yet they use operative time as a basis for not conducting endoscopy . Also in adding another procedure, the transblepharoplasty corrugator resection, they added another site for potential morbidity. Furthermore, they did not account for all anomalous variations in the origin of the supraorbital nerve,[10] and thus the nerve could be damaged with this blind approach. Because they stated their aesthetic results were equivalent with both techniques, it would seem the endoscopic approach would be best even utilizing their own data. In terms of operative time, our average endoscopic brow lift requires approximately 30 to 40 minutes and includes everything from full periosteal release, fixation, biplanar dissection, and fat grafting with pro-fractional laser. I therefore see no basis for not utilizing the scope in regard to operative time issues unless the surgeon is not facile with endoscopic techniques.

Figure 2. (A) Preoperative photograph of this 50-year-old female patient's transverse rhytids. (B) Postoperative photograph 1 year after multiplanar endoscopic brow lift utilizing subperiosteal and subgaleal planes.

Spinelli and others have also criticized the endoscopic approach as not having good application for transverse rhytids. It is interesting to note in the male patient this author shows that the transverse rhytids from the lift alone have all but disappeared. This demonstrates that lifting a ptotic brow alone can improve transverse rhytids. For advanced cases with deep rhytids, we now perform a multiplanar lift with separation of the frontalis from the galea as well as a subperiosteal lift (Figure 2), and, in cases of volume loss, we now add fat grafting as well.

Thus, the endoscopic brow lift has morphed over time with new indications, yet the foundation of the modern procedure still utilizes the original concepts of full release, appropriate elevation, and fixation and long-term results are now the norm (Supplemental Figure 2).

Based on the effectiveness of the procedure in terms of longevity, aesthetics, lack of scar visibility, and versatility, I see no reason to return to the techniques of yesteryear with visible incisions in or around the hairlines as some have recently advocated. Many of the so-called limited lateral brow lifts we have seen discussed in our meetings recently were actually described in the 1970s.[11] Although there may be some limited applicability of these procedures, such as in late recurrence with tissue laxity, why should we place evidence of our surgery in visible areas when it is not necessary? It is a well-known fact that better vision in surgery will allow the surgeon to be more precise and safer than he or she would be otherwise. The endoscope is nothing but a tool to help us see better so we can employ a less obvious approach, which lessens the scar morbidity to the patient and disguises that anything was even done—the ultimate goal of aesthetic plastic surgery. I have never seen a patient with a pre-hairline incision I cannot see. So, I applaud the authors effort as an overall excellent example of the efficacy, safety, and longevity of the endoscopic approach in forehead rejuvenation.

Supplementary Material

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

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ENDOSCOPY IN PLASTIC SURGERY

An Overview

Luis O. Vasconez, MD, Grady B. Core, MD, and Bryan Oslin, MD

Endoscopy is a new method of operating. It involves the introduction of a rigid tube with fiberoptic lighting and a chip camera, which transmits an image to a video screen. To accomplish this, it is essential that an optical cavity be created so that the endoscope can reflect the light and an image be created by the chip camera and then transmitted to the video monitor. Through additional portals of incision, instruments are introduced, which allow the surgeon to perform an operative procedure (an ablation, a removal, or reconstruction by suturing, stapling, and so on).

Endoscopy is a different method of operating because the surgeon, instead of directly viewing the operative field in three dimensions, is now looking at the video monitor; the hands perform the maneuvers with indirect feedback from a two-dimensional video screen. This requires preliminary training because of the separation of hand/eye coordination. This accounts for a considerable loss of tactile perception, which must be relearned using a different paradigm. Nonetheless, the potential advantages of performing operations through minimal incisions warrant the necessary additional training.

Plastic surgery has been slow in adopting the endoscopic techniques, which have been well developed in gynecology, orthopedic surgery, and general and thoracic surgery. As the optical cavity is essential for the utilization of the endoscope, the specialties other than plastic surgery have benefited greatly by the presence of the natural potential cavities of the abdomen, the thorax, and even the joints. One only needs to expand those cavities by the introduction of carbon dioxide or saline for the abdomen and joint, respectively, or by the collapse of the lung for the thorax. In plastic surgery, there are no natural body cavities and, consequently, one has to create the space between the soft tissue and the bone, as in the forehead or between soft tissue and soft tissue, as in the face, the neck, and the breasts, prior to the introduction of the endoscope. This is accomplished by retracting the soft tissues internally by the use of balloons or umbrella-like retractors or externally with the use of sutures, adhesives, or skin hooks. A variety of instruments are needed to accomplish the endoscopic plastic surgical procedures and it is anticipated that more effective instruments will appear on the market that will facilitate the performance of a particular operative procedure. Most of the

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instruments, such as graspers, needle holders, and elevators, have been adapted from instruments presently in use by other specialists.

The rigid endoscopes commonly used in plastic surgical procedures, particularly in the face, are similar to the 4- or 5-mm endoscopes used for arthroscopy. These provide sufficient illumination as well as resolution of the image to accomplish the procedure. The choice of endoscope tip angles allows the operator to use the 0-deg endoscope for direct viewing and the 30-deg endoscope for enhanced viewing around obstacles; for example, the 30-deg endoscope allows better visualization "over" a very convex forehead in endoscopic browlifts.

Plastic surgeons have accepted endoscopy with variable degrees of enthusiasm. For younger surgeons who have been trained through their general surgical background, endoscopy is a natural continuation of their already acquired skills. Older surgeons have found that the learning is not that difficult and can be accomplished fairly rapidly through hands-on courses, particularly with the use of cadavers. Simulators, although not yet available, would offer additional "hands-on" training. There always should be the understanding that an endoscopic procedure could be converted to an "open" one, if the case demands it.

From a different perspective, plastic surgeons are seeking outcome studies with data to establish the effectiveness of the endoscopic techniques, comparing them with the open procedures based on cost, operative risks, and lasting effects. This is a welcome demand and should be done under investigational review board (IRB) protocols at different medical centers with the full acknowledgment and understanding of the patient. It is imperative that data, particularly about complications, be pooled nationally or regionally so that improvements can occur. It is true that one learns more from the complications than from the so-called "excellent results."

The different applications of endoscopy in plastic surgery involve both the aesthetic and reconstructive fields. Given the rapidity of change and advancement of endoscopic plastic surgery, some techniques and indications may differ from those proposed by the authors, who acknowledge this shortcoming and hope to offer an overview with its inherent prejudices, but with no intention to mislead or slow the growth of endoscopy.

HEAD AND NECK

Endoscopy has enjoyed its widest application in the head and neck area, particularly as it relates to aesthetics. Endoscopic sinus surgery is well established, and endoscopic management of facial fractures is evolving.

The Forehead

The endoscopic forehead lift was the first clinical application introduced in endoscopic plastic surgery. When first proposed, it simulated the goals of the open procedure but differed in that, instead of the bicoronal incision, three portals of incision, one in the midline and two equidistant from each other along the temples, were made. The forehead was elevated at the subgaleal level toward the orbital rims to divide the corrugators and the procerus muscles as well as to sharply cross-hatch the frontalis muscle. The eyebrows were repositioned at a higher level, and the dissection of the scalp posteriorly toward the occiput allowed for the accommodation of superior repositioning of the eyebrows. Since its introduction, much has been learned and the procedure has undergone constant modifications. The contributions to our learning on the browlift have consisted of a better understanding of functional mechanics of eyebrow elevation and depression, leading to the hypothesis that one ablates the depressors of the eyebrow, leaving the brow elevator, the frontalis muscle, to elevate the eyebrows unopposed and, in theory, more effectively.

The second significant advance in our knowledge has consisted of the appreciation that division of the periosteum at the level of the supraorbital rims is an essential component of the forehead lift. If this is not accomplished, the eyebrows will not reposition freely at a higher level, as one would like.

The methods of maintaining the elevation of the eyebrows have consisted of the insertion of mini screws, sutures from the galea to the periosteum or to the bone itself, or external bolsters to maintain the eyebrows at the elevated position until the periosteum reattaches itself. Evaluation of the results by various groups shows clearly that, endoscopically, the elevation of the eyebrows is accomplished in the majority of cases. In some cases, it is overdone, which has led one of the

authors (LOV) to abandon the use of fixation and to depend only on ablation of the corrugators and the procerus muscles as well as weakening of the orbital portion of the orbicularis muscle and division of the periosteum. The forehead simply is taped to prevent seroma formation and allowed to re-adhere to the cranium. This technique is satisfactory and offers lasting elevation of the eyebrows.

The Face

Two approaches have been advocated to accomplish a facelift with minimal incision. The first is the subcutaneous approach, which consists of elevating the skin through incisions, usually at the hairline level, and then grasping the redundant tissue and subcutaneously suturing it at a higher level. As this is done, redundant skin becomes apparent and this is taken up in the form of a pleat, again at the hairline level, postauricularly or superiorly. Authors who promulgate this approach[1] indicate that this pleat disappears in a matter of weeks. The procedure is advocated for younger patients who have a minimal amount of excess skin, but the lasting effect of the procedure has not been addressed or tabulated.

The second approach is the subperiosteal one advocated by Ramirez.[4] This is a very correct and impressive approach, which separates the soft tissues of the entire face through multiple small incisions at the hairline level, dissecting subperiosteally in the forehead and at the level of the intermediate fascia in the temple and extending toward the midface and occasionally along the mandible. This approach is aided by blepharoplasty incisions, which are well tolerated by the patient and which help in the communication of the dissection of the upper face with the midface as well as the dissection of the suborbicularis oculi fat (SOOF), which is then grasped, elevated, and sutured with considerable tension to the temporalis fascia. Superb results are shown by Ramirez, and this procedure appears to be of lasting benefit. Some of the concerns that have been pointed out include the extensive dissection that may result in prolonged soft-tissue swelling for weeks or months and, in some cases, by a radical change in the appearance of the patient, which may require prolonged adaptation by the patient. The contribution of Ramirez of the subperiosteal approach is important, particularly as it refers to the anatomic evaluation and simplification of the layers of the temporalis fascia. Its division into superficial, intermediate, and deep temporalis fascial layers has simplified the nomenclature confused by others. Injury to the frontal branch of the facial nerve is minimized by admonitions by Ramirez that the periosteum in the forehead is continuous with the intermediate fascia and that one should approach the intermediate fascia from the lateral aspects superiorly rather than from the superomedial aspect laterally. Also, the blepharoplasty incision facilitates the entrance to the midface and communicates with the upper face. His anatomic studies of the SOOF and his contributions to the improvement of the nasolabial and nasojugal folds as well as the jowls are formidable.

The Neck

Endoscopy also has been applied for plication of the platysmal muscle in the midline through a small incision and also for inspection following suction-assisted lipectomy over the platysmal muscle to prevent the persistence of globules of fat that may present as lumps in the postoperative period.

BREASTS

Endoscopic plastic surgery has found a second application in the breasts. For this, a right-angle retractor adapted with the endoscope is used to manipulate the optical cavity.

Augmentation Mammoplasty

With the popularity of the axillary approach for an augmentation mammoplasty, it is now possible to perform that procedure with more elegance and to more accurately create a pocket symmetric on both sides to accept the saline implant.[3] The planned pockets are usually marked ahead of time symmetrically on both sides, and the dissection is begun bluntly, followed by division of the lower border of the pectoralis major muscle along its insertion under endoscopic control. The endoscope also aids in securing adequate hemostasis.

The endoscopic axillary approach also has been used for the correction of capsular contractures or malpositions of breast implants through the axilla. To accomplish this, the implants are not necessarily removed but can be retracted and used to create a larger optical space for division of the inferior, medial, and lateral capsule under endoscopic control.

Ptosis Correction and Reduction Mammoplasties

Both procedures have been accomplished with satisfactory results by Dr. Faria-Correa[2] with the use of his mammoscope, an endoscope that obtains the optical cavity by having attached to it a windshield-type of projection. He accomplishes the ptosis correction by freeing up the breast along its base and repositioning it with sutures at a higher level. He accomplishes the reduction mammoplasty through the use of a rotary knife, which shaves off the base of the breast thus reducing its height and then allowing for the expected skin shrinkage to decrease the size of the breast. Another possible approach has been advocated by Vasconez et al,[5] and it is based on the anatomic observations that one can free up the skin and subcutaneous tissue from the underlying breast tissue itself, as well as free up the breast tissue from its posterior attachments along the pectoralis fascia while maintaining the blood supply to the skin and subcutaneous tissue and to the breast. Through the axillary approach, by elevating the skin and subcutaneous tissue, one exposes the entire breast mound, which then can be repositioned at a higher level with sutures in the case of ptosis, or can be reduced by resection of the axillary tail or a wedge from the central portion and reconstituted with sutures. Only a limited number of clinical cases have been performed, and under IRB approval, the procedure has to be considered investigational at this time.

Gynecomastia

Subcutaneous mastectomy using a transaxillary endoscopic approach for gynecomastia has been performed by the Emory Clinic group as well as the Ochsner Clinic group. The techniques differ in that the Emory group begins the dissection in the subglandular plane (following tumescent liposuction) and then dissects the residual gland by looking up with the endoscope, thus dissecting the gland off the roof of the optic cavity. The Ochsner group also uses tumescent liposuction but then performs a resection of any residual breast tissue by beginning with a subcutaneous blind approach, using long facelift scissors. Depth is controlled by manual palpation. This leaves the gland to be resected lying on the chest wall, with a uniform layer of skin and subcutaneous tissue above. After division of remaining peripheral attachments, the gland easily peels off the pectoralis fascia for removal through the axillary port.

This procedure by either technique represents a great advantage over prior methods that may leave unsightly scars on the male chest. Experience is still limited with this procedure, and those patients with a lot of excess skin may not be good candidates for this approach, although the skin will contract to a surprising degree with this technique.

Removal of Benign or Malignant Tumors

The endoscope may have significant applications to the removal of benign or malignant tumors of the breast as more experience is obtained. This only has been tried in cadavers and in the laboratory but conceptually it is a very fertile field for future development. The same can be said for axillary dissection, which can be done endoscopically through an axillary incision, yet through only slightly shorter incisions than what is necessary for the open approach.

ABDOMEN

Considerable studies as well as some clinical experience are now available for the endoscopic plication of the diastasis recti in young women with a mild amount of abdominal laxity. In most patients, the endoscopic correction of the diastasis is performed in conjunction with liposculpture of the abdomen, flanks, and back.

Presently, the plication of the diastasis is done by obtaining the optical cavity by elevating the overlying abdominal skin and subcutaneous tissue over the midline and on each side of the anterior rectus sheath, which

is relatively easy after the syringe liposculpture. Then, through a suprapubic incision, and aided also with an additional incision at the umbilicus, endoscopic instruments are used to place a running suture of nonabsorbable material. The use of staples, as advocated by some (LOV), has been abandoned in our practice because, after the liposculpture, the skin and subcutaneous tissue is relatively thin, which allows palpation of the staples. The suturing from the epigastrium toward the pubis endoscopically does take time and a considerable amount of training. For patients who are to undergo plication only from the umbilicus toward the pubis, we see no advantage of the endoscopic approach because a small suprapubic incision and fiberoptic retractor are sufficient to accomplish the plication. However, if no suprapubic incision is planned or if it is the short vertical type (see article on endoscopic abdominoplasty by Core et al elsewhere in this issue), then the endoscope can be of benefit in this area.

Other authors have advocated the intraperitoneal plication of the diastasis recti. It has disadvantages, in that it requires expansion of the abdomen with the introduction of intraperitoneal CO_2 and it produces an evagination of the tissues, which is felt as a bulge along the midline. This bulge is aesthetically displeasing and goes counter to the usual midline depression.

SUMMARY

The advances in endoscopic plastic surgery are exciting. Only with time will the best indications for the endoscope in aesthetic and reconstructive surgery be delineated. In the interim, continued ideas and innovations will push forward the limits of our understanding and allow a fresher look at the rationale for many of the procedures performed.

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