INTRODUCTION

The midface is the central portion of the face. Its superior boundary extends from the inferior orbital rim to the root of the helix. Inferiorly, the border is more oblique, from the oral commissure to the insertion of the earlobe. The lateral boundary is the masseter muscle and medially, the nasofacial groove and nasolabial fold separate the midface from the nose and upper lip.

Each third of the face ages in a distinct fashion. Consequently, rejuvenation of each facial component presents its own set of challenges. Over the last two decades, a better understanding of the effects of aging in the midface led to an increased attention to this anatomic area. In fact, the descent of the malar fat pad and the associated changes to the lower eyelid and orbital complex, nasolabial folds and mandibular jowls are often the earliest manifestations of the aging face.

Significant research and experience has accumulated with regard to treatment of the midface. While some surgical approaches have fallen out of favor due to suboptimal results and longevity, others have stood the test of time and continue to produce consistent and powerful results. New techniques continue to be explored and written about each year. While different techniques exist to treat each aspect of the face, successful cosmetic surgery must strive to achieve a youthful and balanced appearance to the face as a whole.

The goals of this chapter are to review the midface anatomy, the changes specific to the aging midface and the treatment methods that have evolved over the past two decades.

MIDFACE ANATOMY

Safe and effective treatment of the aging midface necessitates a thorough understanding of the anatomy. As the primary midface lifting modality involves an approach via the forehead, this anatomy will also be reviewed briefly.
Scalp and Forehead

The primary muscles of the scalp are the frontalis and occipital muscles. The frontalis is the main elevator of the brow. The opposing muscles of the brow, the depressors, include the orbicularis occuli, the corrugator supercilii and the procerus muscles. The brow elevators and depressors are all innervated by the frontal branch of the facial nerve, with the exception of the procerus, innervated by the buccal branch. The layers of the scalp include the skin, subcutaneous tissue, aponeurosis or galea, loose areolar tissue and periosteum. The galea is continuous with the temporoparietal fascia (TPF) laterally. Notably, the TPF is continuous with the superficial musculoaponeurotic system (SMAS) inferiorly in the face.

Fascial Layers

Multiple anatomical planes exist between the forehead, temporal area and midface, each separated by fascial layers and condensations. To grasp the surgical approaches to the midface and avoid injury to the frontal branch of the facial nerve, these anatomical relationships must be understood. As mentioned above, the galea is continuous with the TPF laterally. The TPF is the most superficial fascia, just under the subcutaneous layer of the temporal area, and is the extension of the SMAS above the zygoma. The frontal branch of the facial nerve as well as the temporal artery and vein course within this fascia.8 Deeper to the TPF is the deep temporalis fascia, which exists as a single fascial layer superiorly. Ultimately the deep temporal fascia splits into a deep and intermediate layer at the level of the supraorbital margin. Each layer attaches to the zygoma and forms the periosteum which envelopes that bone. The intermediate temporal fat pad lies between these two layers above the zygoma. Deeper to the deep layer of deep temporal fascia lies the deep temporal fat pad (Figs 1A and B).

Sensory and Motor Innervation of the Midface

The seventh cranial nerve or facial nerve innervates all muscles of facial expression. The frontal branch of the facial nerve is at risk during midface surgery. It is therefore essential to understand its three-dimensional course in order to avoid nerve injury. The frontal branch of the facial nerve crosses superficial to the zygomatic arch, typically as several branches, halfway between the root of the helix and the lateral canthus.9 To estimate the nerve’s course on preoperative markings, Pitanguy’s line is drawn from the inferior aspect of the external auditory canal through a point 4 cm lateral to the lateral canthus (Fig. 2). A more accurate surgical location of the frontal branch has been delineated using the bridging veins that are encountered between the deep temporal fascia and the TPF during the midface lift dissection.10 The largest of these, medial zygomaticotemporal vein (sentinel vein), is a consistent surgical landmark used to identify the nerve’s location within 2 mm (Fig. 3). Sensation to the midface is carried by
the second division of the trigeminal nerve. The primary distal branches include the infraorbital nerve via the infraorbital foramen, a palpable landmark through the skin, and the zygomaticotemporal branch via the body of the zygoma.

Figs 1A and B: (A) Coronal section of temporal anatomy demonstrating the relationship between the fascial layers and the facial nerve and; (B) The path through which the midface is approached.
**Fig. 2:** Pitanguy’s line crossing the zygomatic arch at the midpoint between the root of the helix and the lateral canthus

**Fig. 3:** Operative view of the sentinel vein

### Midface Fat Pads

This complex is composed of the malar fat pad superficially and the orbicularis oculi muscle underneath. Deep to the muscle layer is the suborbicularis oculi fat (SOOF) pad. The SOOF is adherent to the periosteum of the maxilla and infraorbital rim. In addition to the adherence of these structures to each other and ultimately to the underlying periosteum, the osteocutaneous ligaments, notably the zygomatico cutaneous ligaments, participate in midface stability. Weakening and elongation of these ligaments contributes to the inferomedial descent of the midface over time.
Midface Aging

Though brow descent can precede midface aging, the upper two thirds of the face typically develop the stigmata of aging simultaneously. The primary changes in the upper-third include development of brow ptosis and dermatochalasis, both causing hooding and redundancy of the upper eyelids, and forehead rhytids.

The classic changes associated with midface aging are a direct result of descent of the midface complex described above. Descent of these structures typically begins in the fourth decade. Superiorly this descent causes elongation of the lower eyelids and loss of soft tissue coverage of the infraorbital ridge. At the same time, pseudoherniation of fat against the septum of the lower eyelids gives an unwanted prominence. The uncovered bony ridge is therefore visible and lies between the contour of the lower lid fat and the convexity of the inferiorly displaced malar fat pad and SOOF complex. This is referred to the double convexity deformity. Inferiorly, the inferomedial descent of the midface results in deep ending of the nasolabial folds (Fig. 4).

When evaluating the middle third of the face and educating a patient on the process of midface rejuvenation, it is essential to assess the status of facial volume. While repositioning of tissue with a lift will repad the infraorbital rim and move the existing facial volume into a more youthful distribution, this will not replace the volume loss that is a primary component of facial aging. The gaunt or skeletal appearance of a patient with significant bony and soft tissue loss must be addressed to fully restore a more youthful appearance. In terms of midface volume, attention should be drawn to the infraorbital complex, the malar prominence, the temples and the nasolabial folds. Volume replacement techniques will be addressed below.

TREATMENT

Treatment of midfacial aging has evolved significantly over the past two decades. While rejuvenation of the midface was addressed in the literature prior to 1990s, Hamra’s papers on deep plane and composite rhytidectomy drew focus onto the middle third of the face as a target for aging face surgery. In his deep plane technique, blunt finger dissection is used to mobilize the malar fat pad free from the zygomaticus major and orbicularis oculi. This dissection is achieved via a short skin flap extended sub-SMAS approach. Lateral advancement of this flap, which now includes a component of the midface complex, results in significant improvement of the nasolabial fold. However, the changes associated with midface descent as described above are due to a vertical or inferomedial descent of this structure. Therefore, the vector of pull with the deep plane rhytidectomy is not sufficient to adequately resuspend the midface in a more youthful position. The composite rhytidectomy extends the deep plane technique to include the inferior portion of the orbicularis oculi in
the flap. While the infraorbital area is better addressed with this technique, lower lid malposition and ectropion are known risk factors and prolonged facial edema is to be expected postoperatively.

The introduction of endoscopic technique in facial plastic surgery created the opportunity to address the midface both via smaller hidden incisions and in a more comprehensive anatomical manner. The endoscopic approach to the midface, first written about by Ramirez, has been refined by the senior author (VCQ) and after over 1200 cases remains the preferred technique in this center. The details of this approach are discussed below.

Other surgical techniques to address the midface have been described. The lower eyelid, or transblepharoplasty, approach was reviewed in 2000 by Hester et al. This is a direct approach to the midface with vertical vector fixation. Though this technique has been documented to successfully

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**Fig. 4:** The double convexity deformity in the lower eyelid and inferior orbital rim and the descent of the malar fat pad creating a prominent nasolabial fold characteristic of midface aging
elevate the central cheek area, the redundant temple skin is not addressed and a 19% revision rate is reported especially pertaining to postoperative lower lid malposition.

The thread-lift for midface lifting received significant attention over the past decade. The theoretical advantage of barbed suture lifting included a reasonable result with minimal downtime and limited skin incision. A recent analysis of long-term results after thread lifting documented only transient improvement. This helps to confirm the mounting consensus that barbed suture lifts have poor long-term sustainability.

To treat midfacial aging in a comprehensive fashion, addressing facial volume loss in addition to the descent of soft tissue is essential. Volume loss is multifactorial, a result of diminished facial fat, atrophied facial muscles and even loss of youthful bony contours and projection. Together these deficiencies result in a gaunt, skeletal appearance and contribute significantly to the look of an aging face. Restoration of facial volume is accomplished using either structural implants, such as the malar or submalar implant, fat grafting or synthetic fillers. Recently, fat grafting and synthetic fillers have become standard means to replace volume. Lipotransfer is used throughout the midface from the lower eyelid complex to the nasolabial folds and pre-jowl area. A variety of synthetic fillers are available for treating different areas of the face. In this center, poly-L-lactic acid is frequently used to augment midfacial volume when fat transfer is not being performed. Hyaluronic acid and calcium hydroxylapatite are also utilized to address focal areas of volume depletion such as the nasolabial folds and tear troughs. While filling in areas of volume loss does not physically reposition ptotic soft tissue, volume replacement does work to recontour areas plagued by volume loss. Not only does volume replacement restores a more youthful look, this recontouring can provide an illusion of more superiorly positioned tissue. For example, by filling in the lower eyelid complex to eliminate the double convexity due to midface ptosis, the midface appears to be positioned in its more youthful, superolateral position.

OPERATIVE TECHNIQUE

Our technique for endoscopic midface lifting utilizes the same hairline incisions as endoscopic forehead lifting. In describing the endoscopic midface lift, it is therefore necessary to review the endoscopic forehead lift dissection as it sets the stage to approach the midface.

The patient is examined preoperatively in the upright position and brow assessment is performed. The decision to maintain, elevate or lower the brow is made. Though medial brow position is typically maintained, resection of the procerus and corrugator muscles, primary brow depressors, reduces the chance of postoperative brow depression. This enables treatment of horizontal forehead rhytids with botulinum toxin without risking further brow ptosis.
Preoperative markings are then performed. The temporal line is marked after manually palpating muscle contraction as the patient clenches his or her teeth. The lateral incision over the temporalis is marked 1 cm behind the hairline starting anteriorly just inferior to the superior aspect of the temporalis muscle. The line continues 3 cm inferolaterally. The marking is placed 1.5–2 cm inferior to the superior temporal line to allow suspension sutures to ultimately be placed into the deep temporal fascia superior to the incision. A medial incision mark is placed a few millimeters behind the hairline, centered over the lateral canthus, extending for 2 cm. Pitan-guy’s line, corresponding to the course of the frontal branch of the facial nerve as described above, is also drawn out. Finally, markings are placed at the supraorbital notches. These marks are made bilaterally.

Local anesthesia is infiltrated. A combination of 0.5% lidocaine with 1:200,000 epinephrine and 0.25% bupivacaine with 1:200,000 epinephrine is used at this center. 40 mL are used. In the temporal region the anesthetic mixture is injected superficial to the deep temporal fascia. The injection is subperiosteal at the forehead, anterior face of the maxilla, infraorbital rim, zygoma and anterior zygomatic arch.

After prepping and draping the patient, a No. 10 blade is used to make the lateral incisions, beveling the cut parallel to the hair follicles. This will avoid alopecia around the scar and minimize postoperative visibility. Though approximately 5% of patients experience telogen effluvium typically characterized by up to 1 cm of alopecia around the incision, this hair should return within 9 months if the incisions are beveled appropriately. The incision is carried through the TPF to the level of the deep temporal fascia. A double hook is used to retract the skin superiorly and a Ramirez EndoForehead “T” Dissector No. 4 (Snowden Pencer, Tucker, GA) is used to elevate the superficial temporal fascia and overlying tissue off the deep temporal fascia to the temporal line. The EndoForehead “T” Dissector is applied at a 45-degree-angle to achieve the proper plane. Once the adherent fascial attachments of the temporal line have been released, the dissection continues in a subperiosteal fashion. The dissection continues posteriorly to the occiput to allow the forehead and lateral temporal soft tissue to redrape without bunching anteriorly after suspension.

The EndoForehead “T” Dissector is used in a similar manner inferior to the skin incision, remaining just superficial to the deep temporal fascia. A fiberoptically lighted Aufrecht retractor is used to optimize visualization as the dissection proceeds inferiorly. Anteriorly, the fascial attachments of the temporal line are released and the subperiosteal dissection proceeds along the supraorbital rim. Next the Ramirez EndoForehead Arcus Marginalis Dissector No. 6 (Snowden Pencer) is used to release the arcus marginalis from lateral to 1 cm lateral to the supraorbital neurovascular bundle. Bimanual dissection is performed with a hand placed on the surface of the skin to help prevent injury to the orbit as the arcus is released off the supraorbital rim. Laterally the conjoint tendon is released off the bone with the EndoForehead “T” Dissector. This is essential to allow proper elevation of the lateral brow.
The medial incision is made with a No. 10 blade down to the frontal bone. A Ramirez EndoForehead Frontotemporal Dissector Curved No. 2 (Snowden Pencer) is used to elevate a subperiosteal pocket. Screw holes are hand drilled with a preset stop of 4 mm, preventing penetration past the calvaria. Placing the screw holes at this point allows exact measurement of desired brow elevation from the preoperative brow position. This component of suspension corresponds with medial brow elevation, as the forehead flap between the two medial incisions moves as a sheet superiorly. In our experience, when the medial incisions are resuspended 8 mm superiorly, this translates into maintenance of the preoperative medial brow height. Therefore, to achieve 4 mm of brow elevation, the screw holes are placed 12 mm from the anterior edge of the incision. Temporary screw fixation is used to suspend this portion of the forehead. The screws are removed 1 week after surgery.

The rest of the forehead elevation is completed using the EndoForehead Arcus Marginalis Dissector, elevating medial to the supraorbital bundles, over the glabella and onto the nasal radix. Next the endoscope is passed through the medial incisions and the supraorbital neurovascular bundle is freed with a small pick via the periosteum and brought into endoscopic view. A Ramirez EndoForehead Periosteal Spreader No. 7 (Snowden Pencer) is used to complete the arcus marginalis and conjoint tendon release under endoscopic guidance. The corrugator supercilii and procerus muscles are resected and cauterized, eliminating vertical and horizontal glabellar furrows postoperatively. Occasionally, an asymmetric orbicularis oculi myotomy is performed to address preoperative brow asymmetry.

As the dissection along the deep temporal fascia continues inferiorly toward the zygoma, care must be taken to avoid injury to the frontal branch of the facial nerve. Key surgical landmarks are the bridging veins that pierce the deep temporal fascia and span the plane of dissection before entering the TPF. As mentioned above, a cadaveric study has demonstrated these veins to be within 2 mm of the frontal branch. It is important to preserve these vessels whenever possible in order to prevent engorgement of the temple veins postoperatively. If cautery is necessary, the veins are freed 360 degrees and put on tension. Cautery is applied to the deep aspect of the vessel at the deep temporal fascia. Bipolar cautery is used. These steps prevent conduction of cautery heat superficially toward the frontal branch.

As the dissection proceeds, sufficient downward pressure is exerted to stay on the deep temporal fascia without penetrating this fascial plane. Penetration exposes the deep temporal fat pad, and even minimal trauma can cause fat atrophy and resultant temporal wasting. Just superior to the zygomatic arch, at the level of the supraorbital ridge, the deep temporal fascia splits to form the intermediate and deep layers of deep temporal fascia. The intermediate temporal fat pad exists between the two. It is preferable to elevate the intermediate fat pad in the dissection, staying on the true deep layer of deep temporal fascia. This additional padding of
soft tissue superficially further insulates the frontal branch from thermal or mechanical trauma. Care is taken to preserve a 1 cm cuff of tissue just lateral to the lateral canthus to prevent long-term lid distortion postoperatively.

Once the zygomatic arch is reached, the superior aspect of the perios- teum is incised at its anterior aspect with the Ramirez EndoForehead “T” Dissector. The periesteal incision is carried posteriorly to approximately 1 cm from the external auditory canal. An EndoForehead Arcus Marginalis Dissector is used to release the perios- teum over the anterior face of the zygomatic arch. The zygomaticofacial foramen is frequently encountered and kept intact. The dissection proceeds medially over the infraor- bital rim to the nose in a blind fashion. Bimanual dissection is performed to protect both the globe and the infraorbital nerve. The dissector is passed between the index finger protecting the globe and the thumb protecting the infraorbital nerve (the foramen is easily palpable through the skin). The dissection starts again at the zygomatic body and proceeds inferiorly along the anterior maxilla to the pyriform aperture, inferior to the infraor- bital nerve. The dissector is swept superiorly, releasing the perios- teum off the bone up to the nerve. The gingivolabial mucosa should not be violated during this process.

Under direct visualization with the lighted Aufrecht retractor, the tendinous attachments at the lateral aspect of the maxilla are lysed with the EndoForehead Arcus Marginalis Dissector. With a downward motion, the masseteric tendon is cut just inferior to the inferior aspect of the zygomatic arch. The dissection proceeds directly on top of the masseter muscle fibers, deep to the masseteric aponeurosis, to approximately 1 cm superior to the gonial angle. The medial subperiosteal midface dissec- tion pocket and lateral submasseteric aponeurosis pocket are connected with a sweeping finger dissection from medial to lateral. This breaks the remaining fascial and perios- teal attachments and allows for full mobility of the extended centrolateral midface flap including the midface, malar fat and SOOF.

The midface is ready to be suspended. A 0-Vicryl on a UR-6 needle (Ethicon) is used. A bite of the perios- teum just lateral to the zygomatico- facial foremen is tacked to the deep temporal fascia at a vector superior and slightly lateral. With proper midface dissection, the skin overlying the angle of the mandible should move superiorly 1–1.5 cm with this maneuver. The second suspension suture is placed superior to Pitanguy’s line in the flap and again tacked back to the deep temporal fascia. Three final suspension sutures are placed at the anterior skin edge through the TPF and tacked to the deep temporal fascia posterosuperiorly in the region of the temporal line (Fig. 5). These three sutures suspend the excess temporal skin that bunches after midface elevation. If the lateral incision is placed too close to the temporal line, these sutures are not possible and bunching in the temporal area results. Because hair follicles change direction in this area, any temporal hair-bearing skin is not removed even if there is excess at the time of closure. In time, the excess skin redistributes and flattens completely.
Finally, the midforehead lift is performed by placing two 14 × 4 mm removable screws into the previously drilled holes. The forehead flap is elevated until the anterior aspect of the medial incision is resting against the screw. A staple is placed just behind the screw to secure this positioning. The lateral temporal incisions are closed with interrupted vertical mattress 5-0 nylon sutures. A bulky light pressure dressing is placed over the forehead region. In Figures 6A and B one can appreciate the improvement in appearance of the midface.

**COMPlications**

The outcomes of midface lifting continue to demonstrate effective facial rejuvenation and a low complication rate. Revision surgery rate remains less than 1%. The complication profile has been reviewed in detail previously. Transient complications, including hematoma, infection, engorgement of temple veins and temporary alopecia, occur in less than 1% of cases.

The primary concern in this approach is injury to the frontal branch of the facial nerve. There have been no instances of permanent frontal branch paralysis in our practice. Risk of temporary paresis is 1%, due to thermal or traction injury. Every patient recovered function by 1 year, and most demonstrated full recovery at 6 months postoperatively. Brow asymmetry or abnormal brow position is a possible complication. Care must be taken
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...to avoid aggressive elevation of the medial brow by placing the medial incisions directly over the lateral brow and intentionally working toward a conservative change in medial brow position. Postoperative brow asymmetry may be a result of technical error but is more commonly due to preoperative asymmetry. This is commonly due to a hyperactive frontalis, sometimes as a compensation mechanism for unilateral lid ptosis. Careful preoperative brow position assessment and a frank discussion with the patient about any baseline asymmetries are essential to avoid postoperative dissatisfaction.

Eyelid distortion is an expected transient postoperative phenomenon and must be discussed with the patient preoperatively. The superolateral pull of the midface lift necessarily exerts a pull on the lateral canthal region. This results in lengthening of the lower lid, more scleral show lateral to the limbus and a more elevated appearance to the lateral canthus.

Figs 6A and B: Patient before and after endoscopic midface lift. (A) Frontal and (B) Three-fourth view
By preserving the cuff of tissue lateral to the lateral canthus during the dissection and initiating circular massage in this area at postoperative day 10, patients can expect a relaxation of the pericanthal tissue and return of the preoperative lid appearance (Figs 7A and B). Minor revisions to the lateral canthal area are performed in less than 0.5% of cases. It is important to note that ectropion is not a complication of the endoscopic midface lift. In fact, a previous study demonstrated that following a midface lift the force required to distract the lower eyelid away from the globe increases two fold. The midface lift allows aggressive resection of redundant lower eyelid skin and reduction of vertical eyelid height without concern for ectropion.
Before the lateral canthus relaxes, patients can report dry eye symptoms. This is likely due to both decreased tear film circulation and increased scleral exposure. Use of natural tears and night time ointment alleviates this complaint until the lid resumes its baseline position and function. Chemosis lasting greater than 2 weeks occurs in 25% of cases. These patients are managed with steroid and hypertonic saline eye drops. Complete resolution can be expected by 6–8 weeks postoperatively.

Tenderness with chewing is an expected transient issue. Suture suspension to the deep temporal fascia and dissection along the masseter muscle and aponeurosis cause inflammation in the postoperative period. This typically resolves within 48 hours and can be mediated with the use of nonsteroidal anti-inflammatory medications.

Facial edema is another expected component of the postoperative period with any lifting procedure. The edema after a midface lift is typically more dramatic due to the broad subperiosteal dissection. Patients can expect resolution of this edema by 3 weeks, though it can persist up to 6 weeks. Edema that extends beyond 6 weeks is considered prolonged edema and occurs in 5% of patients. Massage to encourage lymphatic drainage and conservative use of diuretics are used to expedite resolution in these cases.

CONCLUSION

The endoscopic midface lift remains an effective and safe technique for mid-third facial rejuvenation. By performing the wide subperiosteal dissection centrally and the extended subfascial release laterally over the masseter, the midface can be lifted in the superolateral direction. This vector is necessary to address both the ptotic midface complex and the nasolabial crease. The technique described above differs in key ways from the approach originally described by Ramirez.\(^5,18\) Here the entire dissection is performed via temporal incisions without the use of a gingivolabial incision. Also, our dissection extends along the entire length of the zygomatic arch and inferiorly to just above the gonial angle. Without this extended release the mobility of the midface unit is limited in the authors’ experience.

A retrospective review of the authors’ case series has shown that this technique results in improvement of several areas of facial aging. From most to least dramatic, this approach results in: (1) correction of midface ptosis and infraorbital hollowing, (2) improvement of the depth of the nasolabial fold, and (3) improvement of the degree of jowling.\(^7\) Addressing volume loss in these target areas of the midface with either fat transfer or synthetic fillers further augments the rejuvenation seen following the endoscopic midface lift. In this center, the midface lift continues to be an essential tool in treating the aging face with safe and reliable results.
REFERENCES


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