The positioning of the eyebrow is important for maintaining a periorbital contour and symmetry that is aesthetically pleasing. Many authors have described formulas for positioning the “ideal” brow, but in reality this depends on the patient’s characteristics. Each person has unique physical attributes that make him or her attractive, and there is no formula that can encompass these factors. The surgeon must look at each eyebrow on an individual basis.

**Etiology**

The positioning of the eyebrow is affected by such factors as brow elevator and depressor muscles, genetics, gravity, skin laxity, surgery, trauma, and the patient’s expressivity. All or some of these factors result in brow ptosis. Although each eyebrow has its own shape, position, and contour, in general the female eyebrow should lie approximately at or above the superior orbital rim. It should have a curve with the tail of the brow higher than the head of the brow. The male eyebrow should be at the level of the superior orbital rim with a less curved configuration. When planning brow surgery, the imbalance between the elevators (frontalis muscle) and the depressors (orbicularis oculi, depressor supercili, corrugators, procerus) must be addressed.

The frontalis muscle originates at the skin and superficial fascia of the orbicularis muscle. It inserts into the galea aponeurotica. The main function of the frontalis muscle is to elevate the eyebrows, and it is responsible for the transverse rhytids in the forehead. The corrugator muscle originates at the medial orbital rim and inserts into the frontalis muscle and skin of the eyebrow. It primarily shortens the glabellar space and causes descent of the tail of the brow. It is responsible for the vertical glabellar frown lines. The orbicularis oculi muscle originates at the medial orbital rim and medial canthal tendon and inserts on the medial aspect of the bony orbit. It depresses the total brow and is responsible for vertical rhytids. The depressor supercili muscle also originates at the medial orbital rim and medial canthal tendon, and it inserts on the medial aspect
of the bony orbit. It is responsible for depressing the head of the brow. The procerus muscle originates at the nasal bone fascia and upper cartilages. It inserts onto the skin at the medial lower forehead. Like the depressor supercilii, the procerus depresses the head of the brow. It is responsible for the horizontal rhytids at the radix of the nose. These muscles comprise the forehead musculature with which the surgeon must be thoroughly familiar for endoscopic dissection.

Clinical Evaluation

The surgeon must recognize the fundamentals of forehead rejuvenation by understanding the changes that occur in the aging upper face. Forehead ptosis should be suspected in every patient who has redundant upper eyelid skin even if the eyebrow appears to be in a normal position. Many patients lift up the eyebrow with their finger when they want eyelid surgery (Flower’s sign). This should be a cue to the surgeon to evaluate the patient for forehead, not eyelid, surgery. This should also help begin to align the surgeon with the patient’s expectations. Upper eyelid skin hanging over the eyelid margin in the lateral periorbital area (Connell’s sign) is also a feature of forehead ptosis. The patients should be evaluated in repose to determine the situation accurately. Those with deep transverse forehead creases also suffer from forehead ptosis. Patients sometimes present with chronic forehead spasms, giving a falsely normal brow height. It is important to have the patient relax the forehead by gently closing the eye, which relaxes the frontalis muscle. This muscle is then blocked with the examiner’s finger and the patient opens his or her eyes gently. The true level of the brow can then be measured accurately. The most common error is assuming that forehead ptosis is not present because the eyebrow appears normal. It is also important to note that patients, women more than men, pluck their lateral brow to give the illusion that it is higher. It is also important to note any brow tattoos that are present. Often, patients will have tattoos placed higher than their actual brow position to correct the appearance of brow ptosis. Presence of these tattoos should be noted and discussed with patients prior to surgery.

The goal of endoscopic forehead surgery is to elevate the brow, decrease forehead rhytids, decrease vertical glabellar rhytids, improve lateral canthal hooding, and decrease infrabrow skin. A proportional face should be divided into equal thirds, and a balanced face should be five eyewidths wide. Patients should be given a handheld mirror during the examination. This gives them the opportunity to look at themselves and specifically point to areas of concern. They can also describe their goals. Watch carefully for Flower’s sign, and look for Connell’s sign; this practice allows you to show them possible realistic surgical outcomes. Additionally, this practice allows the surgeon to demonstrate the contribution of brow position as well possible dermatocchalasis to upper eyelid crowding. A lid creaser device can help demonstrate what a blepharoplasty alone might accomplish versus forehead elevation. Document this in writing and with photographs. It is best to determine a standardized approach to recording brow position in the patient’s chart.

Two useful preoperative quantitative measurements are the glide test and the frame height. The glide test measures brow excursion in the medial, central, and lateral portions of the brow. The frame height measures the distance from midpupil to the top of the brow. Typically, the best improvements using the endoscopic forehead procedure occur with frame heights of 1.5–2.0 cm and glide test values of 2.0–3.0 cm. It is more common to undercorrect than overcorrect brow height. Most surgeons lift the brow 1.0–1.5 cm.

Medical Management

Once the forehead evaluation is complete, the surgeon must develop a management plan. Medical management with botulinum toxin can be used for mild brow ptosis. This is a temporary measure, lasting around 3–4 months. Injection of superolateral portion of the orbicularis oculi muscle below the lateral third of the brow can achieve elevation of the brow. In some female
patients, injection into the central orbicularis oculi below the brow can alleviate some brow ptosis. This technique may be used independently or in conjunction with a forehead lifting procedure. For moderate to severe brow ptosis, however, botulinum toxin alone is unlikely to produce a significant, noticeable change. It is essential for those administering botulinum toxin to understand that placing this medication in the frontalis muscle will not raise the brow. This will inhibit frontalis function and may lower the brow and/or decompensate the frontalis effort that the patient is using to keep the brow elevated.

**Surgical Management**

Several surgical options exist for lifting the brow. Preoperatively it is important to discuss the patient’s goals and expectations to determine the appropriate surgical option. If the patient is interested in lifting the brow for functional purposes only, and they don’t mind the potential resultant scar, direct or temporal direct brow lifts are good options. These procedures involve excising an ellipse of tissue directly above each brow. A midforehead lift is an option in patients with deep forehead rhytides. The incision line is marked the entire length of the forehead within a forehead furrow and an ellipse of tissue is excised (Fig. 2.1). An internal brow pexy or transblepharoplasty brow lift is performed through an upper blepharoplasty incision by dissecting to the superior orbital rim and fixating the brow with either suture or fixation devices. Cosmetic options include pretrichial, coronal, and endoscopic forehead lifts. A pretrichial forehead lift is best used in patients with a high forehead, as it is a forehead shortening technique. A pretrichial incision just anterior to the hairline and a direct visualization dissection is carried out to release the forehead. A coronal approach raises the forehead through an elliptical scalp incision anterior to the coronal suture extending from ear to ear. Finally, an endoscopic forehead approach allows a minimally invasive forehead lift with incisions hidden in the hairline (Video 2.1).

For an endoscopic forehead lift, marking is critical when planning for the surgery (Video 2.2). The supraorbital nerve can be measured approximately 2.4 cm from the midline, and the supratrochlear nerve is usually 1.6 cm from the midline. Sometimes branches of the supraorbital nerve are located more temporally and supply the surface of the skin. An arch extending 1.5–2 cm above the brow is marked to prevent injury to the supraorbital nerve. This nerve exits at the notch most frequently but emerges from a foramen up to 1 cm above the brow (Fig. 2.2). Blunt subperiostial dissection can be done up to this point. A 1 cm safety zone is marked in the temporal area to prevent injury to the facial nerve. Blunt dissection can be performed temporally with reasonable safety up to this point.
One central, two lateral, and two temporal incisions are made (Fig. 2.3). Sometimes only two paracentral and two temporal incisions are needed. The central incision is marked at 1 cm behind the hairline, extending 1.0–1.5 cm in length. The paramedian incisions are marked approximately 4.5 cm lateral to prevent injury to the superficial branches of the supraorbital nerve, which supply sensation between these areas. This incision extends 1.0–1.5 cm in length. The fixation points for the scalp are marked just anterior and lateral to the paramedical incisions superior to the area of the brow with the desired maximal arch in a female. In a male, more medial placement of the fixation points will allow for the more masculine “T-shaped” brow. The temporal markings are done 2.5 cm posterior to the hairline, extending 3.5 cm in length. The midline of this incision is perpendicular to a line drawn from the lateral nasal ala to the lateral canthal angle. In the presence of male pattern baldness, these incisions can be made behind the fringe line. The temporal incisions help raise the lateral canthal angle and temporal brow. Many surgeons prefer to excise an ellipse at the temporal incisions. This reduces the skin redundancy when the temporal area is elevated. Typically this ellipse would be no more than 10–15 mm in thickness.

There is a temporal crescent that separates the two areas of dissection: the frontal pocket and the temporal pocket. This crescent is where the periosteum transitions to the deep temporal fascia and where the galea aponeurotica and superficial temporal fascia fuse. Anatomically, this is referred to as the conjoint fascia/tendon or the superior temporal septum. It can be palpated along the lateral portion of the superior orbital rim, and it extends superolaterally. It is more pronounced when the patient clenches the jaw. A marking is placed at the right and left lateral orbital rims at the level of the lateral canthal angle. In the presence of male pattern baldness, these incisions

![Incision sites for endoscopic foreheadplasty. The X marks the supraorbital notch, and the dotted line encloses an area where dissection is performed with direct visualization.](image)

Fig. 2.3 Incision sites for endoscopic foreheadplasty. The X marks the supraorbital notch, and the dotted line encloses an area where dissection is performed with direct visualization.
zygomaticotemporal (sentinel) vein. This is an important landmark at it denotes approximate location where the temporal branch of the facial nerve traverses the dissection plane to become more superficial. The temporal branch of the facial nerve runs from the lower portion of the tragus to 1.5 cm above the temporal eyebrow. It originates deep near the parotid gland and courses superiorly over the periosteum at the zygomatic arch. It then becomes more superficial and runs on the deep surface of the superficial temporalis fascia before entering the undersurface of the frontalis muscle. The sentinel vein should be the extent of the lateral dissection for the procedure.

Many cases are performed under local anesthesia with sedation. When first starting this procedure, it may be wise to use general anesthesia in the event the patient becomes uncomfortable or moves. A 50/50 mixture of 2% lidocaine with 1:100,000 epinephrine and 0.5% bupivacaine with 1:100,000 epinephrine is used for bilateral supraborbital nerve blocks. The same mixture is then administered along the surgical markings, across the entire forehead and along the lateral orbital rims. Always limit the amount of lidocaine and bupivacaine to a safe dose for the patient’s weight.

A No. 15 blade is used to incise along the temporal incision/ellipses. Blunt dissection is carried out to identify the superficial temporalis fascia. Once identified, a skin flap is removed to expose the superficial temporalis fascia. Further dissection is carried to expose the deep temporalis fascia, which is immediately superficial to the temporalis muscle. This fascia is a shiny, white, fibrous glistening tissue. The plane at the superficial layer of the deep temporalis fascia is the plane of dissection (Fig. 2.4). The temporal branch of the facial nerve lies within the

![Fig. 2.4 Anatomy in the temporal area. The dotted line is the appropriate plane of dissection](image-url)
superficial temporalis fascia and is superior to the surgical plane, out of harm’s way. The temporal artery is often encountered during this dissection. It should be ligated or avoided if possible. Blunt dissection using a flat elevator and/or finger dissection is performed toward the lateral orbital rim, staying at least 2 cm from the mark at the lateral canthal angle denoting the approximate area of the sentinel vein.

The endoscope is now introduced through the temporal incision above the deep temporalis fascia. A blunt elevator and blunt dissection with scissors is used to dissect toward the lateral canthal angle under direct visualization. At the lateral orbit, the orbicularis-temporal ligament is visible as a tough ligament joining the lateral orbicularis and the deep temporal fascia. The sentinel vein is encountered just beyond this point. It is typically 5 mm temporal to the zygomaticofrontal suture line. It is here that branches of the facial nerve are located, so the dissection should be minimal. Once the sentinel vein is visualized, no further dissection inferior or most lateral is required. The lateral canthal angle can be released under direct visualization.

Attention is then turned to the central and lateral incisions. A No. 15 blade is used to incise the skin and scalp down to the periosteum. Using a flat elevator, blind blunt dissection is carried out across the forehead in the subperiostial plane, avoiding the area marking the supraorbital nerve. The procerus muscle is detached using a flat elevator either blindly or under direct visualization with the endoscope to reduce the horizontal rhytides at the radix of the nose. The temporal and central pockets are connected blindly, laterally too medially, detaching the conjoint fascia/tendon. If necessary, under direct endoscopic visualization, sharp dissection with scissors may be used to sever all attachments of the conjoint fascia/tendon, taking care to remain in the appropriate plane. Dissection should be carried out until the periosteum is completely released across the orbital rim. The periosteum and galea should be horizontally severed for adequate release (Fig. 2.5).

The arcus marginalis is then released along the superior orbital rim, lateral to medial, avoiding the supraorbital nerve. This can be undertaken blindly using either an elevator or finger dissection. The endoscope is once again brought into the field to identify the supraorbital nerve. Once the supraorbital nerve is located, a supraperiosteal pocket is formed above the bridge of the nose to address the depressor muscles (procerus, corrugator, depressor supercili, and orbicularis). Using blunt dissection, the tissues are moved side to side to separate the muscles for better visualization. At this point the tough corrugators can be seen with their insertion and origin on both sides. The corrugators can be avulsed, rather than cut, to prevent injury to the supratrochlear nerve. This can be accomplished with endoscopic scissors or laser. Branches of the supratrochlear nerve are sometimes seen within the corrugator and should be avoided. The depressor supercili should also be avulsed and not cut because of vessels within it.

Fixation

Once the periosteum has been adequately released, attention is given to fixation. There are many methods available to fixate the scalp. The key to the endoscopic forehead procedure is not as much the fixation as it is the release of the periosteum and the muscles. Anchor or screw techniques for fixation include use of an internal screw or plate, Mitek anchor, external screw, and k-wire. Other techniques include galea-frontalis-occipitalis release, use of lateral suspension sutures or bolster fixation sutures, anterior scalp port excision, galea-frontalis advancement, creation of a cortical tunnel, and use of tissue adhesives. The Endotine™ forehead fixation device (MicroAire Aesthetics, Charlottesville, VA) was introduced in 2003. The anchoring device is made of a biodegradable, polyactic acid implant on a triangular platform with five times and a bone peg for attachment. Regardless of the technique, it must achieve simplicity, reproducibility, safety, and long-term results. If the fixation is under tension, brow ptosis occurs. We prefer Endotine™ fixation (Video 2.3).
The site for the planned Endotine™ placement is approximately 1.0–1.5 cm from the anteriormost portions of the lateral or paracentral incisions. A Bovie cautery can be used to score the bone to reduce slippage of the drill. The Endotine™ drill bit has a cutting surface and a stop to prevent drilling too deeply into the outer calvarium. Gentle downward pressure should be exerted on the drill while the other hand rotates the drill. Once drilled, the Endotine™, grasped by an insertion device, is inserted, ensuring it is perpendicular to the bone. The Endotine™ should snap into position and should not easily move. The scalp is pulled superiorly and placed onto the Endotine™ (Fig. 2.6). The central and temporal incisions are closed using staples or suture.

The superficial temporalis fascia is advanced and closed used buried, interrupted 2–0 PDS suture. The incisions are then closed using skin staples or suture.

Postoperative Care

After the hair is washed with shampoo, ABD pads and Kerlex dressings are placed around the forehead for 24 h. Complete wound healing usually occurs within 42–60 days. Postoperative antibiotics, anti-inflammatories, and analgesics are provided at the discretion of the physician. The staples are removed in 7–10 days. Patients usually can return to work in 3–5 days. They are instructed preoperatively that scalp numbness
may persist for 3 months, and “hair shock” can result in some alopecia around the incision sites also, lasting 3 months.

A worrisome complication is injury to the facial nerve, but it can usually be avoided by carefully dissecting in the correct plane. Hematomas and infections are rare. This procedure can be performed on bald patients with minimal scarring.

Endoscopic foreheadplasty is an accurate procedure that has a higher patient acceptance rate than the traditional coronal lift. With good technique, release, and fixation, the results are long lasting. It is a nice addition to the surgeon’s armamentarium of brow lift procedures.

Fig. 2.6  Brow fixation technique with Endotine
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