

Aesthetic Brow-lifts: Review of Contemporary Nonsurgical and Surgical Approaches

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Eye-brow position plays a considerable role in facial expression and perception; therefore, patients often present to the cosmetic practitioner for treatment of brow ptosis. The underlying pathophysiology of brow ptosis has undergone great advances in recent years, and there are numerous nonsurgical and surgical options available to lift the brow. Nonsurgical techniques include chemodenervation, fillers, laser resurfacing, radiofrequency, and ultrasound therapy. Surgical approaches include coronal, endoscopic, pretrichial or trichophytic, mid forehead, direct incision, and transblepharoplasty brow-lifts. To effectively communicate with patients and maximize patient satisfaction, the practitioner must be aware of both the goals and complications of the various nonsurgical and surgical methods used in the treatment of brow ptosis.

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Eye-brow position is of primary importance in beauty and facial expression. In the aging face, a drooping brow may convey unintended expressions of anger, sadness, fatigue, or hostility (Figure 1), which can have a negative effect on a patient's self-esteem.¹ Repositioning the forehead and brow through a variety of surgical or less invasive procedures can restore a patient's natural facial expression to one that appears alert, friendly, and

interested. Although the primary focus of functional brow surgery is to improve the patient's visual field, aesthetic brow-lifts also must address symmetry, elevation, contour, and wrinkle reduction. Modern brow-lifting techniques are considered to be largely effective with low complication rates and high patient satisfaction.²

HISTORICAL PERSPECTIVE

The first-known review of brow-lift techniques was reported in 1919.³ Aesthetic brow-lifts have been included in facial rejuvenation for more than a century. In the last 2 decades, however, our understanding has greatly increased regarding the fundamental anatomical changes of brow aging and subsequent techniques for addressing brow ptosis. Therefore, the modern practitioner has access to a broad range of nonsurgical and surgical techniques. In addition to technique, patient satisfaction ultimately hinges on the physician's understanding of normal forehead anatomy, changes associated with aging, and modern brow aesthetics for patient expectations.

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Figure 1. A patient with substantial brow ptosis causing an unintended angry expression.

BROW POSITION AND SHAPE

Ideal facial proportions and aesthetic facial analyses have been defined in textbooks such as Powell and Humphreys⁴ *Proportions of the Aesthetic Face*. These texts provide guidelines and context for the modern aesthetic practitioner, as ideals have changed over time; for example, we have observed that modern female supermodels have low brows and hairlines. Classically, ideal facial proportions have been determined either by dividing the face into equal horizontal fifths or Leonardo da Vinci's thirds, which include the areas from the trichion to the glabella, the glabella to the subnasale, and the subnasale to the menton.¹ The latter method can be complicated by the variability of the hairline in both sexes; therefore, eyebrow position is a key landmark in any forehead-lift, and the ideal shape and position of the brow must be considered. Brow shape and height is gender dependant. Anthropologically, individual variations in the brow have been noted for their usefulness in differentiating between the sexes.⁵ The physician must be careful not to create a female-shaped brow in a male patient, and vice versa. The female eyebrow is tear shaped, elongated, and medially broad with lateral tapering. The medial female brow is located just over the supraorbital rim and peaks somewhere between the lateral limbus and the lateral canthus before tapering downward, though it stays above the supraorbital rim. In females, the brow-tip aesthetic line, found between the medial brow and lateral nasal root, should form a smooth unbroken line.⁶ Brows are thicker in men and travel more horizontally along the supraorbital rim without substantial tapering.⁷ The appearance of the forehead itself also is gender dependant; men tend to have more frontal bossing and a more prominent supraorbital rim. Both male and female hairlines must be taken into consideration in forehead evaluation.

ANATOMY AND PATHOPHYSIOLOGY

An understanding of the anatomy and an appreciation for the pathophysiology of brow position is integral to effective cosmetic evaluation and treatment of the aging face. The scalp has 5 layers: the skin, subcutaneous tissue, galea aponeurotica, loose areolar tissue, and periosteum. The skin, subcutaneous tissue, and galea move as a single complex. The galea connects the frontalis muscle to the occipitalis muscle and is a tendinous inelastic sheet. Laterally, the galea is attached to the fascia of the temporalis muscle. The frontalis muscle originates from the galea and inserts beneath the skin of the forehead and fascia. The frontalis is the primary brow elevator. The brow depressors include the paired corrugator supercilli, the procerus, and the medial aspect of the orbicularis oculi known as the depressor supercilli. Vertical glabellar rhytides are formed by the corrugator, while the procerus is responsible for the transverse glabellar rhytides. The temporal branch of the facial nerve supplies the frontalis, corrugator, and orbicularis oculi, and the buccal branch of the facial nerve supplies the procerus. To preserve nerve function during any surgical forehead procedure, the practitioner must be attuned to the course of the temporal branch of the facial nerve. This branch emerges from the parotid gland 2.5 cm anterior to the tragus and runs obliquely, passing 1.5 cm lateral to the lateral orbital rim. In terms of depth, over the zygoma it is just superficial to the periosteum and then travels just superficial to the periosteum to the deep temporal fascia.⁸ Sensation in the forehead is provided by the trigeminal nerve, with most of the relevant brow sensation in this context provided by the first branch; the supratrochlear branch of the trigeminal nerve supplies the medial upper lid and forehead, while the supraorbital branch supplies the central upper lid and forehead. Sensation to the lateral temple is provided by the zygomaticotemporal branch, the second division of the trigeminal nerve.⁹

Forehead aging is caused by a multifactorial process that leads to rhytide formation and brow ptosis. As described by Knize,¹⁰ the lateral brow descends earlier than the medial brow. This difference is related to 3 factors: (1) gravity, which causes the soft tissues of galeal and pre-septal fat pads to slide over the temporalis fascia lateral to the temporal line; (2) decreased resting tone of the frontalis that suspends the medial brow; and (3) hyperactivity of the corrugator and lateral orbicularis oculi, both resulting from and exacerbating brow ptosis.

Forehead aging also is thought to result from soft tissue laxity.¹¹ A decrease in skin and subcutaneous tissue elasticity, an increase in bone resorption, and the effects of gravity over time lead to soft tissue ptosis that tends to start at the lateral brow and progress medially. Initial upper lid hooding eventually can involve the entire brow, glabella,

and forehead. Brow ptosis leads to a compensatory contraction of the frontalis, corrugator, and procerus muscles. Initially, this unconscious contraction only involves the skin, but loss of subcutaneous tissue from aging leads to involvement of the deeper fascia and permanent rhytides are formed. Skin type, sun exposure, tobacco use, and gender also are contributing factors.

PATIENT EVALUATION

As in any aesthetic physician-patient encounter, patient evaluation is critical, as it will influence whether the physician opts for a nonsurgical or surgical approach and allows for communication between both parties regarding preferences and expectations. Patients should be asked about their specific concerns as well as their history of brow fatigue and headaches. The bony contour of the face, extent of brow and lid ptosis, rhytide formation, hairline pattern, skin type, photoaging, and facial symmetry should be evaluated. Preoperative photographs should be taken in a standardized format; they can be helpful in both preoperative and postoperative counseling, noting dynamic asymmetries.¹²

Hairline evaluation, including position, shape, and balding pattern (if applicable), plays an important role in the treatment of brow ptosis and may direct the physician's choice of surgical technique to minimize visible scarring. Patterns of baldness have been described in both sexes by Ludwig¹³ and Norwood.¹⁴ The photoaging classification of Glogau¹⁵ and the patient's Fitzpatrick skin type¹⁶ should be taken into consideration, as these factors may affect scarring.

Patient awareness of static and dynamic preoperative asymmetry is important to ensure the achievement of acceptable results and to maximize patient satisfaction. Orbital and forehead asymmetry is observed in more than 85% of patients, including numerous supermodels.¹⁷ As part of the evaluation of asymmetry, the practitioner should note any signs of a peripheral or central seventh cranial nerve palsy as well as any substantial orbital fat atrophy.

In addition to reviewing the patient's standard medical and surgical history, specific notation should be made of any prior blepharoplasty, alopecia, or dry eye symptoms. If needed, an ophthalmologic consultation should be obtained.

NONSURGICAL APPROACHES

Nonsurgical approaches to forehead rejuvenation include chemodenervation, fillers, laser resurfacing, radiofrequency, and ultrasound therapy. Depending on the patient, these approaches can be used alone or in combination with other surgical procedures. In addition, any discussion of forehead aging should include primary

and secondary prevention. Primary prevention methods include sun avoidance and UV protection, including UVA and UVB chemical and physical blockers. Secondary prevention techniques include retinoids, antioxidants, and other skin care products.⁷

Chemodenervation with botulinum toxin type A has become a popular, minimally invasive method of addressing forehead aging. The idea that a balance of muscular forces affects brow height and shape over time has led to the use of various botulinum toxins as a chemical brow-lift. Chemodenervation with 16 to 20 U of botulinum toxin type A injected into the brow depressors leads to unopposed frontalis action, causing an average brow elevation of 1.02 mm at the midpupillary line and 4.83 mm from the lateral canthus.¹⁸ Injecting an additional 10 U along the superior orbital rim can achieve additional elevation of the central brow (Figure 2).¹⁹ There is speculation that repeated denervation of the brow depressors over time may retard forehead aging.²⁰ Patients with mild to moderate brow ptosis may benefit from chemodenervation before proceeding to more permanent surgical options.



Figure 2. Brow ptosis before (A) and 6 weeks after chemodenervation with botulinum toxin type A (B).

BROW-LIFTS

Unlike chemodenervation, which lifts the brow, soft tissue fillers can be used to volumize deficient and asymmetric areas. Originally used to treat lipodystrophy related to human immunodeficiency virus, injectable poly-L-lactic acid can be used to fill the temples (off label) but should be avoided in the periorbital area. Hyaluronic acid fillers have gained popularity in brow treatments (off label) because of their safety profile when administered near the eyes, as well as their immediate effects, minimal patient downtime, and potential for reversal. Hyaluronic acid fillers in the brow have been shown to last for 2 years.²¹ In addition, the effect of the filler can be previewed by injecting dilute lidocaine with epinephrine at the treatment site. Lambros²² advocated a technique of diluting the hyaluronic acid itself to achieve a more even fill.

Ablative CO₂ laser resurfacing can improve superficial forehead rhytides, sun damage, and skin tone, but will not have any effect on underlying heavy muscles. Often performed as an adjunct to other procedures, the laser does not substantially lift or fill the brow, but it addresses various skin changes that contribute to forehead aging. Chemical peels can produce similar results but may have more variability in depth of penetration.

Radiofrequency technology provides a nonsurgical nonablative method for treating skin laxity and age-related rhytides. Controlled delivery of radiofrequency energy to the dermal and subdermal layers can stimulate collagen production and remodeling.²³ Radiofrequency devices have been shown to produce a mild objective brow-lift, but it may not always be perceptible to patients and results may be dependant on the device.²⁴

In 2009, the US Food and Drug Administration approved Ulthera (Ulthera, Inc), a focused ultrasound delivery device, for the first nonsurgical face-lift. High-intensity focused ultrasound waves create highly confined thermal damage at specific depths within the dermis,²⁵ creating similar changes within the skin as seen in ablative and nonablative light or laser treatments.²⁶ Simultaneous ultrasound imaging allows for the visualization of the distinct structures within the face.²⁷ A clinical trial showed an average lift of 2 mm in the brow with a single treatment.²⁸

SURGICAL APPROACHES

Surgical technique can be divided into one or a combination of approaches, including coronal, endoscopic, pretrichial or trichophytic, mid forehead, direct incision, and transblepharoplasty brow-lifts. No single technique or combination of techniques is notably superior, and each has its own advantages and disadvantages; therefore, surgical approaches to brow-lifts should be based on the patient's clinical characteristics, expectations, and preferences, as well as the surgeon's level of expertise

and comfort with various approaches. The most notable factors to evaluate when selecting a surgical technique are the location of the anterior hairline and the height of the forehead. Typical incision locations for surgical brow procedures are shown in Figure 3.

Considered to be the most traditional technique,⁷ the coronal brow-lift is suited for patients with a normal to low hairline, as the results will elevate the forehead 2 to 3 times the amount of brow elevation achieved.²⁹ The incision is created 4 to 10 cm posterior to the hairline and extends the width of the scalp. Approximately 1 to 2 cm of tissue is removed, and the forehead is everted after the periosteum is elevated away from the cranium. At this point, the corrugators can be directly excised or denervated. The main advantages of the coronal technique are excellent exposure and elevation of the brow. However, there is potential risk for hypoesthesia; hair loss; hematoma; and a splaying apart of the 2 brows, which can be a sign of aging.⁷

The endoscopic lift, first described in 1994 by Isse³⁰ and Vazconez et al,³¹ is considered state of the art⁷ because of its ability to camouflage scars, its dependence on the

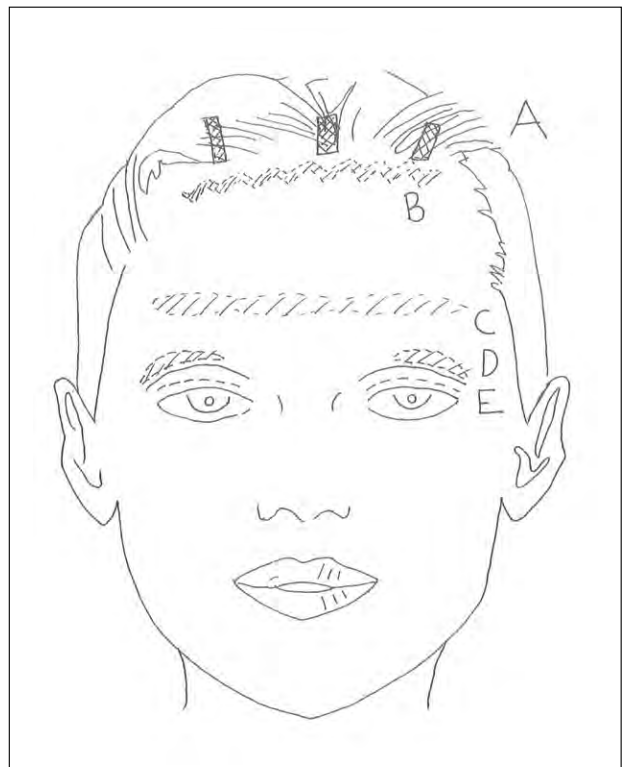


Figure 3. Typical incision locations for the following surgical brow procedures: endoscopic (A), pretrichial (B), mid forehead (C), direct incision (D), and transblepharoplasty (E) brow-lifts. Illustration courtesy of Michael Ehrlich, MD.

utilization of new technology, and its rapid increase in popularity.²⁹ The ideal patient for this technique has thin skin, prominent glabellar rhytides, minimal brow ptosis, and minimal skin redundancy. Because the endoscopic technique may increase forehead height, a high forehead may be a relative contraindication, as this procedure can elevate the hairline.³² Various methods of suspending the brow have been used, including temporary titanium screws, fixation directly to the cranium, and absorbable devices such as polylactide homopolymer. Another endoscopic brow-lift technique may not raise the hairline because the corrugators are ablated and denervated without suspending the brow. Although the endoscope allows surgery through smaller incisions, male pattern baldness or a strong family history of baldness also may be relative contraindications. In addition, patients with tight and thick skin, such as Asian or American Indian patients, may be poor candidates.⁷ Advantages of the endoscopic approach include shorter recovery time, less visible scarring, minimal scalp sensory change, relative safety, low complication rate, and high patient satisfaction.³³ Disadvantages include the need for specialized training and equipment, higher operative costs, and less direct surgical exposure.⁷

Using the endoscopic technique, 3 to 5 access incisions are made at least 1 cm posterior to the hairline. These incisions are followed by the generation of frontal and temporal optical cavities, subsequently releasing the frontal ligaments and arcus marginalis. Often the depressor muscles of the brow are ablated.³⁴ The main lift in an endoscopic procedure results from elevation and readhesion of the frontal periosteum, as opposed to soft tissue resection, which can occur by 2 weeks following the operation.²⁹ Some surgeons advocate administering botulinum toxin just before surgery to allow the brow to stay elevated during this time of adhesion of the tissues.

The pretrichial or trichophytic modification of the coronal incision is designed to maintain the height of the hairline and possibly reduce the height of the forehead. This technique is indicated for women who have high foreheads or always wear bangs, as well as for men who have high foreheads or receding hairlines and are candidates for hair transplantation.²⁹ The advantages of this technique include better control of forehead height and the possibility of an improved hair-bearing scar if a meticulous technique is utilized. This technique also does not rely on a subperiosteal release; instead, a beveled incision is created either in front of or 3 to 4 mm within the hairline, which allows continued growth of dermal appendages through the scar to help camouflage it (Figures 4 and 5).³⁵ The incision length averages 14 cm. A

subcutaneous dissection is performed down to the superior orbital rim. Excess skin is excised and sutured in a similar manner to a superficial musculoaponeurotic system lift. If necessary, ablative CO₂ laser resurfacing can help to camouflage any residual scar.³⁶ Disadvantages of a pretrichial incision include a wider possible area of hypoesthesia and potentially visible scarring, though a survey



Figure 4. A patient 1 month after a pretrichial brow-lift. Within 6 months, the scar will fade considerably and hair will regrow through the scar.



Figure 5. A patient with considerable brow ptosis before (A) and 6 months after a pretrichial brow-lift (B).

of more than 1000 trichophytic patients found that 98% of participants would undergo the procedure again.³⁷

The mid forehead–lift is indicated for men who have prominent deep forehead rhytides and a receding hairline. This approach involves limited dissection of a large forehead rhytide, though the incision may extend across the entire brow. The hairline is not altered and there theoretically is a lower risk for nerve injury or hematoma. The main disadvantage of the mid forehead–lift is the possibility of an obvious visible scar, leading to reports of patient hostility directed toward the surgeon (Figure 6).²⁹ However, some physicians argue that scarring can be minimized with meticulous closure, leading to satisfied patients and physicians.⁷

The direct incision brow–lift is considered to be the easiest and oldest technique. This approach is mainly reserved for older men who have thick eyebrows,²⁹ though some physicians advocate for a more limited incision in females.³⁸ With this technique, a small ellipse of skin and subcutaneous tissue is excised above the brow and sutured. Advantages of this approach include its low cost and high degree of efficacy, simplicity, and safety; however, because the incision is created directly above the brow, it often leaves a visible scar. Thus this technique often has limited use in an aesthetic setting. In addition, the direct incision approach does not address forehead, glabellar, or temple rhytides and ptosis.⁷

The transblepharoplasty brow–lift was described in 1996³⁹ as a method used to perform a subperiosteal brow elevation while simultaneously correcting dermatochalasis. This procedure can be done alone or in combination with a small incision nonendoscopic brow–lift,⁴⁰ browpexy,³⁸ or a polylactide homopolymer–anchored brow–lift.⁴¹ After the blepharoplasty incision is made, the practitioner incises the periosteum of the superior orbital rim and refixates the periosteum and overlying tissues at the desired height. The main advantage of this



Figure 6. A dissatisfied patient who presented for a second opinion of a scar from a prior mid forehead–lift.

procedure is that few, if any, additional incisions are required; however, not all transblepharoplasty techniques address forehead rhytides or brow depressors. A variant of this procedure is an external browpexy in which a stab incision is made just above the follicles and then sutured to elevate the brow.

CONCLUSION

Patients increasingly are seeking practitioners to reposition the forehead and brow. Clinicians should be aware of the etiology of brow ptosis as well as the numerous nonsurgical and surgical techniques available to achieve results that are satisfactory for both the patient and physician.

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Quick Poll Question

Which nonsurgical approach do you use most often for a brow-lift?

- Chemodenervation and/or fillers
- Laser resurfacing and/or radiofrequency
- Ultrasound therapy
- None; always use surgical approach

Go to www.cosderm.com to answer our Quick Poll Question