Endoscopic Brow Lift

James E. Zins, MD, FACS[a,*], Demetrius M. Coombs, MD[b]

KEYWORDS

• Endoscopic brow lift • Ptosis • Facial rejuvenation

KEY POINTS

- Description of the physiology of brow ptosis.
- Mechanism of endoscopic correction of brow ptosis.
- Detailed description of surgical technique.
- Pitfalls and flaws in endoscopic technique leading to adverse outcomes.

Video content accompanies this article at http://www.plasticsurgery.theclinics.com.

INTRODUCTION

Before 1991, the coronal brow lift was the gold standard for the correction of brow ptosis. However, the operation was not without postoperative complications and adverse sequelae including long-term numbness, pruritis, alopecia of the scalp, and scar deformity.[1]

Vasconez and Isse independently introduced the endoscopic brow lift in the early 1990s. Vasconez's approach was a subgaleal one. Isse's procedure highlighted depressor muscle alteration to gain the surgical result.[2–4]

After the introduction of the endoscopic brow, the initial enthusiasm was followed by a more recent decrease in the number of endoscopic procedures performed. The reasons for this were multifactorial. They included reports of dissatisfaction with the results, the quality and longevity of the operation, as well as the emergence of less technically challenging procedures such as the isolated temporal lift, the transpalpebral corrugator resection, and the so-called chemical brow lift using botulinum toxin.[5–10]

TECHNICAL ASPECTS

1. Over elevation of the brow

It is very easy to over elevate the medial brow using the endoscopic technique and it is very easy to place the lateral brow too low. The solution to over elevation of the medial brow is to preserve at least 2 cm of periosteal attachments in the midline glabellar region. The solution to obtaining adequate lateral brow elevation is wide subperiosteal release, which includes release of the superior temporal line, the temporal ligamentous adhesion, and the lateral orbital rim as far as the zygomatic arch.

2. The surprised look

With aging of the upper face, the medial brow often elevates due to static frontalis activation, whereas the lateral brow descends often below the level of the medial brow due to the lack of presence of elevator muscle laterally. This results in hooding of the brow laterally. Over elevation of the medial brow may lead to the so-called surprised look and is harmful to brow esthetics. However, even when over elevated, if brow shape is maintained, over elevation is relatively well tolerated. This highlights the modern dictum of upper face esthetics, which emphasizes maintenance or improvement of brow shape is more important than brow elevation (**Fig. 1**).

[a] Section of Cosmetic Surgery, Cleveland Clinic Department of Plastic Surgery, Desk A 60, 9500 Euclid Avenue, Cleveland, OH 44195, USA; [b] Cleveland Clinic Department of Plastic Surgery, Desk A 60, 9500 Euclid Avenue, Cleveland, OH 44195, USA
* Corresponding author.
E-mail address: zinsj@ccf.org

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Fig. 1. Clinical photographs of a 61-year-old female Fitzpatrick I patient with brow ptosis and a high forehead who presented for facial rejuvenation (*left*). The same patient 3 months postoperatively following extended SMAS facelift and endoscopic brow lift using cortical tunnel technique for bony fixation of superficial temporal fascia to deep temporal fascia for temporal fixation (*right*). The early postoperative view shows over-correction and a surprised look.

PHYSIOLOGY OF BROW CORRECTION

The endoscopic brow lift gains its effect from a very different mechanism than the open coronal lift. The coronal brow lift owes its effect to a purely mechanical mechanism. As a general rule, 2.5 cm of scalp excision results in 1 cm of brow elevation. The endoscopic brow lift, on the other hand, owes its efficacy to an interplay between the elevators and depressor muscles of the forehead. When the depressors of the brow are weakened, the elevators work relatively unopposed.[4,11,12] This is combined with wide subperiosteal release of the superior temporal line, the temporal ligamentous adhesion, and the lateral orbital periosteum (**Fig. 2**). As no skin is excised in the forehead with the endoscopic brow lift, it is this alteration of muscles and periosteal release that gains the effect rather than mechanical pull.

LONGEVITY OF THE ENDOSCOPIC TECHNIQUE

Although some controversy remains regarding the long-term maintenance of the endoscopic brow, multiple studies document the statistically significant correction of brow ptosis long-term[13–17] (**Fig. 3**). More recently, however, it has become apparent that success in brow lifting should not be predicated on brow elevation alone but rather it should focus on maintaining or improving brow shape. The brow lift restores the loss of definition that occurs with aging. This loss of definition of the superior lateral supraorbital rim cannot be obtained by upper lid blepharoplasty alone (**Fig. 4**).

ANATOMY

Several critical structures require highlighting along the lateral aspect of the supraorbital rim, there is a broad retaining ligament or adhesion between the galea and periosteum known as the temporal ligamentous adhesion. This along with the superior temporal line or septum and the supraorbital ligamentous adhesion need to be released subperiosteally to gain lateral brow elevation.

The inferior temporal septum runs from the superior lateral orbital rim to the posterior zygomatic arch. Above this line, there are no important structures. Below this line lie the sentinel vein and the frontal branch of the facial nerve. The sentinel vein lies 1 cm lateral and superior to the lateral canthus. The frontal branch lies 1 cm superior and lateral to the vein. Therefore, once the vein has been visualized, the frontal branch has been passed (see **Fig. 2**).

TECHNIQUE

The key to success with regard to technique is maintaining the proper anatomic planes. This means dissecting on the deep temporal fascia and the superficial layer of the deep temporal fascia in the temple to the lateral orbital rim laterally and subperiosteally at the level of the superior lateral and lateral orbital rim medially.

Operative Steps

1. Five incisions are made. One incision is made in the right and one incision in the left temple on a line from the alar base through the lateral canthus. Three or 4 incisions are made in the scalp several centimeters into the hairline. One incision is made in the right and one incision in the left lateral forehead scalp on a vertical line from the lateral third of the brow. One incision is then made in the midline of the

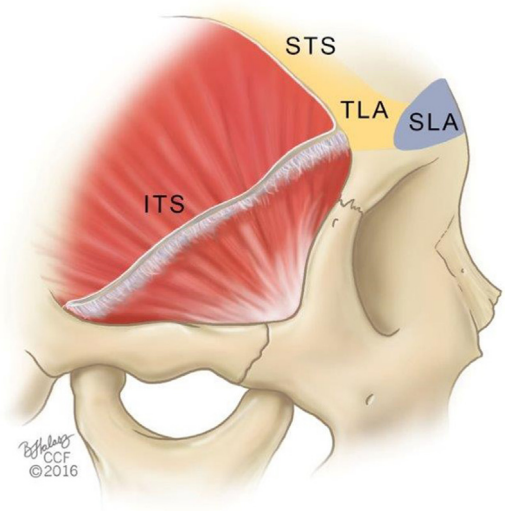

Fig. 2. Anatomic illustration of lateral brow structures including the inferior temporal septum (ITS), superior temporal septum (STS), temporal ligamentous adhesion (TLA), and supraorbital ligamentous adhesion (SLA). (*Courtesy of* Cleveland Clinic Center for Medical Art & Photography, Cleveland, OH.). (Reprinted with permission, Cleveland Clinic Foundation 2022. All Rights Reserved.)

forehead scalp skin or alternatively 2 paramedian incisions are made (**Fig. 5**).

2. The temporal incision is made first. Dissection is taken through the superficial temporal fascia in the deep temporal fascia. Deep temporal fascia is clearly recognized as pure white. The superior temporal line is then released posterior to anterior. It is important to dissect subperiosteally immediately medial to the superior temporal line as the deep branch of the supraorbital nerve lies 1 to 2 cm medial to the line between periosteum and galea. Injury to this nerve can result in numbness or pruritis of the scalp postoperatively. The temporal ligamentous adhesion and the lateral orbital rim are then released subperiosteally into the midface. This allows for not only brow release but also improvement in the midface. As all lateral soft tissue structures are thus released except for the deep head of the lateral canthal tendon, this results in a canthopexy type effect (Video 1).
3. Forehead dissection

The forehead is released subperiosteally through the 3 to 4 forehead incisions sequentially. The subperiosteal release extends down to the supraorbital rims. Two centimeters of periosteal attachment is spared medially at the glabella to prevent over elevation of the medial brow. The arcus marginalis is released in its entirety. The step creates brow elevation (Video 2).

Fig. 3. Clinical photographs of a 61-year-old female Fitzpatrick I patient with brow ptosis and a high forehead who presented for facial rejuvenation (*left*). The same patient 3 months postoperatively following extended SMAS facelift and endoscopic brow lift using cortical tunnel technique for bony fixation of superficial temporal fascia to deep temporal fascia for temporal fixation; the early postoperative view shows over-correction and a surprised look (*center*). The same patient now 68 years old and nearly 7 years postoperatively; long-term follow-up demonstrates stability of the results (*right*).

4. Corrugator and procerus resection

The corrugator muscles and if indicated the procerus are resected. The end point of corrugator resection is skeletonization of the supraorbital nerves and visualization of subcutaneous fat (**Fig. 6**).

Fig. 4. Preoperative photograph of a 51-year-old woman with facial aging, brow ptosis, and lower lid bags (*left*). Postoperative photographs of the same patient at 2 years following endoscopic brow lift, lower eyelid blepharoplasty, and extended SMAS facelift.

5. Bone fixation

Bone fixation is accomplished using the cortical tunnel technique. The tunnel is placed through the posterior aspect of the lateral forehead incision. This is very rapid and safe. The tunnel can be made very superficially. A bone cut approximately 2 mm deep with a very narrow bone bridge or bone island between the anterior and posterior tunnel using a side cutting burr (Video 3).

6. Tail of the brow elevation

This is accomplished by suturing the superficial temporal fascia to the deep temporal fascia in a superior and posterior direction with 1-2 sutures of 2-0 PDS (polydioxanone) suture (Video 4).

ALTERNATIVE MEANS OF FIXATION

A variety of other devices have been used for fixation purposes in addition to the cortical tunnel. This includes Endotines, Mitek suture anchors, and fibrin glue. The literature supports superior fixation with the cortical tunnel technique when compared with fibrin glue.[11] When using the cortical tunnel, Jones and Grover found that permanent sutures were more effective than absorbable sutures with regard to longevity. Finally, multiple authors maintain that broad subperiosteal release is more important with regard to correction than bone fixation. In fact, several authors question the need for bone fixation at all and have demonstrated similar results with and without bony fixation.[15–17]

PATIENT SELECTION

The best candidates for endo brow lift are those with short or normal forehead height, a flat forehead, and those with no receding hairline and minimal true medial skin excess. Conversely, poor candidates are those with a convex forehead,

Fig. 5. Clinical photographs depicting the incisions for endoscopic brow lift. The temporal incision is made on a line drawn from the alar base to the lateral canthus within the temporal hairline. The lateral forehead incision is made on a vertical line from the lateral two-thirds of the brow to correspond to the apex of the brow. The medial incision is for access to the corrugator/procerus muscles. Please note that the incisions are made within the hairline. Marks on the skin are for demonstrative purposes only.

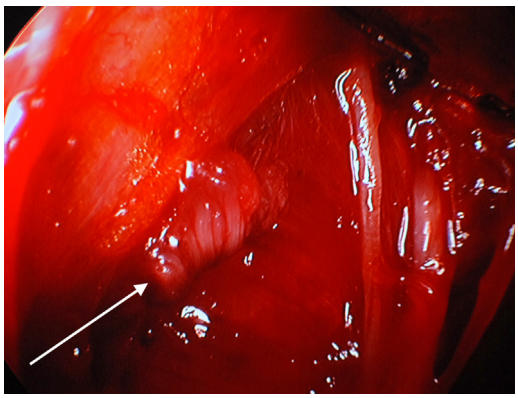

Fig. 6. Intraoperative endoscopic view of a partially resected left corrugator muscle (denoted by the *white arrow*) with supratrochlear branches skeletonized (right aspect of the image).

high hairline, deep rhytids, thick skin, and true medial skin excess (**Fig. 7**).

TRAPS AND FLAWS

1. Early recurrence of glabellar lines

This occurs because of inadequate glabellar muscle removal and is prevented by the removal of all muscle between bone and subcutaneous fat.

2. Asymmetry

True asymmetry needs to be differentiated from asymmetry due to upper eyelid ptosis. True asymmetry is structural and should be noted preoperatively. Differential fixation is indicated. It is a reasonable rule of thumb to mention to the patient that if there is asymmetry preoperatively, there may be some degree postoperatively as well. This true asymmetry should be differentiated from asymmetry due to frontalis activation due to unilateral upper eyelid ptosis. Patients with asymmetry due to unilateral upper eyelid ptosis will often have a high supratarsal fold and crease. In such cases, upper eyelid ptosis repair is indicated.

3. Over elevation

The surprised look results from a combination of overly aggressive medial subperiosteal release, release of the medial depressors, and/or overly aggressive lateral brow elevation. If noted, early fixation can be adjusted.

4. Under elevation of the lateral brow

Inadequate lateral brow elevation results from insufficient subperiosteal release and requires reoperation if significant.

5. Displeasing eyebrow arch

Unattractive brow shape is generally due to excessive medial brow subperiosteal release and inadequate lateral release.

QUALITY OF STUDIES

There are no prospective randomized studies comparing open and endoscopic techniques. Further few studies have compared long-term outcomes of the 2 techniques in detail. Finally, few studies use validated subjective and objective grading systems to assess brow shape long-term.[17–19]

The best study addressing long-term results in endoscopic brow lifting using validated tools was the Jones and Lo report.[19] They found statistically significant brow elevation of 3.5 to 4.7 mm at all 5 points measured medial to lateral across the up to 1 year. At 5 years, statistically significant elevation

Fig. 7. Preoperative photographs of a 63-year-old female with brow ptosis, corrugator hyperactivity, and deep nasolabial folds presenting for facial rejuvenation (*left*). The same patient 14 months postoperatively following facelift, endoscopic brow lift with complete corrugator resection, bone fixation using cortical tunnels, and fixation of the superficial temporal fascia to the deep temporal fascia laterally.

was found at all 5 points again except for the most lateral point on the brow (brow tail). This point had reverted to preoperative baseline. Furthermore, the highest point of the brow was at the medial limbus rather than the lateral limbus. The authors hypothesized that the temporal fixation of superficial temporal fascia to deep temporal fascia was not strong enough to overcome the depressor effect of the lateral orbicularis oculi.

SUMMARY

Success in modern brow lifting surgery is predicated not on brow elevation alone but rather on improving or maintaining brow shape. Therefore, perhaps the term brow lift is a misnomer and the term used should be brow contouring. Technically medial brow elevation should be avoided. Lateral brow elevation requires wide subperiosteal release including the superior temporal line, the temporal ligamentous adhesion, and the lateral orbital rim to the zygomatic arch and into the midface.

Although the amount of elevation is not great, as documented by Jones and Lo, it is enough for consistent subjective improvement according to validated measures.

CLINICS CARE POINTS

- Unlike the coronal brow lift that depends on a pure mechanical pull, success in endoscopic brow lifting depends on weakening of the depressor muscles of the brow and wide subperiosteal undermining of the superior temporal line, the temporal ligamentous adhesion, and subperiosteal release of the lateral orbital rim to the zygomatic arch.
- It is very easy to over elevate the medial brow and easy to under elevate the lateral brow.
- Over elevation of the medial brow is prevented by leaving 2 cm of periosteum attached at the glabellar midline. Under elevation laterally is prevented by wide subperiosteal undermining.
- The key to success technically is remaining in the correct plane. That is on top of the deep temporal fascia and superficial layer of the deep temporal fascia laterally and subperiosteal medially.
- Successful brow lift surgery is not predicated on brow elevation but rather on maintaining or improving brow shape. Perhaps brow shaping rather than lifting is a more accurate term.

DISCLOSURE

All authors have nothing to disclose.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at https://doi.org/10.1016/j.cps.2022.02.003.

REFERENCES

1. Paul MD. The evolution of the brow lift in aesthetic plastic surgery. Plast Reconstr Surg 2001;108:1409–24.
2. Isse NG. Endoscopic facial rejuvenation: endoforehead, the functional lift. case reports. Aesthet Plast Surg 1994;18:21–9.
3. Vasconez LO. The use of the Endoscope in brow lifting. Washington, DC: Annual Meeting 7of the American Society of Plastic and Reconstructive Surgeons; 1992. Video presentation at.
4. Isse NG. Endoscopic forehead lift: evolution and update. Clin Plast Surg 1995;22:661.
5. Chiu ES, Baker DC. Endoscopic brow lift: a retrospective review of 628 consecutive cases over 5 years. Plast Reconstr Surg 2003;112:628–33. ; discussion 634-635.
6. Tabatabai N, Spinelli HM. Limited incision nonendoscopic brow lift. Plast Reconstr Surg 2007;119:1563–70.
7. Rohrich RJ, Cho M-J. Endoscopic temporal brow lift: surgical indications, technique, and 10-year outcomes analysis. Plast Reconstr Surg 2019;144:1305–10.
8. Mass CS, Kim EJ. Temporal brow lift using botulinum toxin a: an update. Plast Reconstr Surg 2003;112(Suppl):109S–12S. ; discussion 113s-114S.
9. Kane MA. Nonsurgical periorbital and brow rejuvenation. Plas Reconstr Surg 2015;135:63–71.
10. Jones BM, Grover R. Endoscopic brow lift: a personal review of 538 patients and comparison of fixation techniques. Plast Reconstr Surg 2004;113:1242–50. Discussion 1251-1252.
11. Knize DM. Limited Incision forehead lift for eyebrow elevation to enhance upper lid blepharoplasty. Plast Reconstr Surg 2001;108:564–7.
12. Knize DM. An anatomically based study of the mechanism of eyebrow ptosis. Plast Reconstr Surg 1996;97(7):1321–33.
13. Guyuron BM. Endoscopic forehead rejuvenation: limitations, flaws and rewards. Plast Reconstr Surg 2006;117:1121–33.
14. Behmand RA. Guyuron BM Endoscopic forehead rejuvenation:11 Long-term results. Plast Reconstr Surg 2006;117:1137–43. Discussion 1144.
15. Troilius CA. A comparison between subgaleal and subperiosteal brow lifts. Plast Reconstr Surg 1999;104:1079–90. Discussion 1091-1092.

16. Guyuron BG, Kopal C, Michelow BJ. Stabilitiy after Endoscopic forehead surgery using single point fascia fixation. Plast Reconstr Surg 2005;116:1988–94.
17. Iblher N, Manegold S, Porzelius C. Morphometric Long term evaluation and comparison of brow position and shape after Endoforehead lift and transpalpebral Browpexy. Plast Reconstr Surg 2012;130:830e–40e.
18. Graham DW, Heller J, Kirkjian TJ, et al. Brow lift in facial rejuvenation: a systemic literature review of open versus endoscopic techniques. Plast Reconstr Surg 2011;128:335e–41e.
19. Jones BM, Lo SJ. The Impact of endoscopic brow lift on eyebrow morphology, aesthetics, and longevity: objective and subjective measurements over a 5 year period. Plast Reconstr Surg 2013;132:226e–38e.