An Algorithm for Correction of the Aging Upper Face

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KEYWORDS

• Brow lift • Coronal brow lift • Minimally invasive • Endoscopic brow lift • Temporal brow lift • Brow ptosis • Nonsurgical brow lift

KEY POINTS

- Brow lifting has evolved substantially over the past several decades with numerous less-invasive techniques largely supplanting the classic coronal brow lift.
- More recently, success in brow lifting is being measured not only by brow elevation alone but also by maintaining or improving brow shape.
- Endoscopic brow lifting and other less-invasive techniques have been popularized more recently, as well as nonsurgical options—each having specific indications and relative contraindications.
- Factors in the algorithm for choosing the ideal approach for each patient range from patient preference for technique invasiveness, brow shape, rhytid depth, hairline status, forehead length, and other considerations, such as age, gender, and medical comorbidities.

INTRODUCTION/BACKGROUND

The pertinent anatomy and ideal brow aesthetics have been addressed in detail in article one of this issue. A variety of brow-lift procedures have then been presented in the ensuing articles. In this article, the authors have attempted to put this wide variety of procedures into context with detailed indications and contraindications to each. Finally, an algorithm for choosing the proper brow-lift procedure is proposed.

APPROACHES TO CORRECTION OF THE AGING UPPER FACE

Open Techniques

Coronal brow lift

For the 30 years before the 1990s, the coronal brow lift was the mainstay for treatment of brow ptosis and forehead rhytids. Flowers and Ceydeli,[1] great proponents of the coronal lift, maintained that brow elevation alone would improve forehead rhytids by eliminating the need for constant contraction of the frontalis muscle resulting from brow ptosis. In addition, they observed that by performing an upper-lid blepharoplasty in patients with brow ptosis, one can risk worsening the aesthetic result by removing the need for compensatory frontalis elevation. This may lead to an unsatisfactory result and worsening brow ptosis.

Despite long-term efficacy of the coronal lift, there are significant drawbacks that discourage its use. This includes potential for poor or widened scars, alopecia, and sensory loss. Because the deep branch of the supraorbital nerve runs between galea and periosteum just medial to the superior temporal line, it is more prone to injury during the coronal lift's subgaleal dissection (**Fig. 1**).[2–4] This can lead to chronic pruritis and other sensory changes. Although alopecia may occur temporarily in as many as 33% of coronal brow lifts, in many patients this resolves within 6 months.[5] Finally, patients often find the long scar a significant concern and therefore decline the procedure. Despite these drawbacks, the

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Clin Plastic Surg 49 (2022) 415–420
https://doi.org/10.1016/j.cps.2022.03.005
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Fig. 1. Cadaver demonstration of the course of the deep branch of the supraorbital nerve. This branch passes 0.5 to 1.5 cm medial to the superior temporal line between periosteum and galea. It is therefore prone to injury during subgaleal dissection.

coronal brow lift remains the standard by which long-term efficacy of brow correction should be measured.

Coronal brow-lift indications:
- Significant brow ptosis
- Thick, sebaceous skin
- Deep forehead rhytids
- Normal or low forehead height

Coronal brow-lift relative contraindications:
- Thin or balding scalp
- Concerns regarding scarring
- Concerns for alopecia
- Minimal or isolated lateral brow ptosis

Endoscopic brow lift

The endoscopic brow lift introduced in the early 1990s appeared to avoid many of these drawbacks. It was touted as a minimally invasive technique with less scarring and a shorter recovery.[6–10] This initial enthusiasm was tempered when concerns regarding less-than-ideal results, early relapse, and other technical issues arose.[11] Specifically, overcorrection of the medial brow and lack of lateral brow elevation were common early findings. However, with increased experience, such problems have generally been overcome (**Figs. 2**A–D and **3**A–D). Medial brow elevation can be minimized by leaving at least 2 cm of periosteum attached at the glabellar midline. Lateral elevation is maximized by wide subperiosteal dissection, including the superior temporal line, the temporal ligamentous adhesion, and the lateral orbital rim extending down to the zygomatic arch. Wide subperiosteal undermining is generally considered more important than bone fixation. In fact, some question the need for any bone fixation.[12–14] Long-term studies by Jones and Lo[15] documented subtle, but persistent, correction of brow ptosis of just more than 4 mm at all points along the brow, except for the lateral-most point at the tail of the brow. This point reverted to its preoperative position 5 years after surgery.

Endoscopic brow-lift ideal candidates and surgical indications:
- Short or normal forehead height
- Flat forehead
- No true medial skin excess
- Nonreceding hairline
- Desire for small scars even with sparse hair
- Desire for minimally invasive procedure
- Minimal to moderate brow ptosis

Endoscopic brow lift: less than ideal candidates and relative contraindications:

Fig. 2. (*A*) Preoperative frontal view of a 64-year-old woman who underwent extended SMAS facelift, subperiosteal endoscopic brow lift, and lower lid blepharoplasty. (*B*) Seven-month postoperative frontal view of patient seen in (*A*). (*C*) Preoperative profile view of patient seen in (*A*). (*D*) Postoperative profile view of patient seen in (*A*). SMAS; superficial musculo aponeurotic system.

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Fig. 3. (*A*) Preoperative frontal view of a 64-year-old woman who underwent deep plane facelift and endoscopic subperiosteal brow lift, perioral phenol croton oil peel, and fat grafting to the lower eye lids and malar region. (*B*) Postoperative frontal view of patient seen in (*A*). (*C*) Preoperative profile view of patient seen in (*A*). (*D*) Postoperative profile view of patient seen in (*A*).

- High or receding hairline
- Convex forehead
- Thick, sebaceous skin
- Deep frontalis lines
- True medial excess skin

Temporal brow lift

More recently, the importance of brow shape has been realized. Success in brow-lift surgery is not predicated on brow elevation alone. Eyebrow shape is perhaps even more important than brow elevation. This concept has been heralded in procedures, which address the lateral brow specifically, including the isolated temporal lift performed through a temporal hairline incision and the temporal lift performed through a limited lateral hairline incision, as described by Matarasso in article 4 of this issue.[16]

The isolated temporal hairline approach can be performed endoscopically[17,18] or under direct vision, as described by Knize and Spinelli.[19,20] This technique primarily addresses ptosis of the lateral third to half of the brow, the most common finding regarding the aging brow.[20,21] The dissection is taken down under direct vision to the deep temporal fascia, and then the dissection is extended onto the superficial layer of the deep temporal fascia medially to the lateral orbital rim. This is done with or without release of the superior temporal fusion line and the temporal ligamentous adhesion, depending on the severity of brow ptosis. This leads to correction of the loss of definition to the superior lateral orbital rim that occurs with aging. The isolated temporal lift as described by Matarasso includes a short hairline incision lateral to the midline, a subcutaneous forehead dissection, and an elliptical excision of forehead skin at the forehead-hairline junction. The isolated temporal lift, when performed under direct vision, avoids the special equipment needs of the endoscopic approach. The medial brow depressor muscles, the corrugators, and procerus can also be treated at the time of temporal brow lifting by several ancillary means, including transpalpebral muscle resection, endoscopic resection, or botulinum toxin.

Temporal brow-lift indications:
- Need for isolated lateral brow elevation
- Short forehead
- Sparse hair
- Mild to moderate lateral ptosis

Temporal brow lift requires ancillary techniques to address the following:
- Need for medial brow elevation
- Need to modify corrugator muscles
- Deep rhytids

Hairline brow lift

The hairline brow lift, which involves a W-plasty–type incision the full length of the forehead-hairline junction, has noted a resurgence in recent years in part owing to the increased incidence of facial feminization surgery. The versatility of the hairline brow lift allows for both brow elevation and significant hairline lowering when a posterior subgaleal dissection is performed.[22,23] Relapse of brow lowering can be mediated using galeal scoring incisions parallel to the incision and cortical bone tunnels combined with progressive tension sutures (**Fig. 4**A–D).

Hairline brow-lift indications:
- High hairline
- Thin skin
- Thick hair
- Revision brow lifting

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Fig. 4. (*A*) Preoperative frontal view of a 62-year-old woman who underwent extended SMAS facelift, hairline brow lift, and forehead-lowering procedure, including posterior subgaleal dissection, galeal scoring, and progressive tension sutures using cortical tunnels for fixation. (*B*) Three and a half years postoperative frontal view of patient seen in (*A*). (*C*) Preoperative profile view of patient seen in (*A*). (*D*) Postoperative profile view of patient seen in (*A*).

- Desire for facial feminization
- Desire to lower forehead height

Hairline brow-lift contraindications:

- Short forehead
- Receding hairline
- Significant brow asymmetry

Direct brow lift

Pelle-Ceravolo and colleagues in article 8 of this issue demonstrate that the direct brow lift does not need to be limited to elderly men. In a large patient series, Pelle-Ceravolo and Angelini[24] demonstrate outstanding results with minimal scars. Consistent with the current trend regarding brow shape, this operation allows for exacting brow-shape correction. The incision is tailored to the problem.[25,26] When lateral brow ptosis is all that requires correction, the incision can be limited medially, further minimizing the scar.

Direct brow-lift indications:

- Elderly men
- Medial brow elevation
- Selective tail elevation
- Unilateral brow ptosis
- Receded hairline
- Refuse major surgical procedures
- Compromised health, contraindications to general anesthesia

Direct brow-lift relative contraindications:

- Concerns regarding brow scar
- Short forehead
- History of hypertrophic scarring

Gliding brow lift

Exciting developments include newer techniques, such as a gliding brow lift, introduced by Viterbo and colleagues[27] and recently popularized by Grotting. Grotting provides a detailed discussion and numerous preoperative and postoperative photographs in article 5 in this issue. The procedure is an extension of the hemostatic net.[28]

It avoids any significant scar entirely. A blind subcutaneous dissection is performed through small hairline stab incisions. Fixation is performed using transcutaneous sutures to first elevate the brow, and then additional running transcutaneous sutures are used to fix the forehead skin in place. Transcutaneous sutures remain in place for 48 hours only.

The benefit of scarless, minimally invasive surgery cannot be overstated, and Grotting's results are impressive. However, questions remain. This includes the questionable accuracy of the plane of dissection, the possibility of frontal branch injury if the subcutaneous plane is violated in the region of the frontal branch of the facial nerve, and the need for documentation of long-term efficacy.

Gliding brow-lift indications:

- Mild ptosis

Gliding brow-lift relative contraindications:

- Deep rhytids
- Thick sebaceous skin

Botulinum toxin injection

Finally, the chemical brow lift using botulinum toxin offers the possibility of subtle brow elevation as a minimally invasive office procedure.[29,30] Of course, the results are temporary and require reinjection on a 3- to 4-month basis. Botulinum toxin can also be used in combination with the isolated temporal lift to address corrugator muscle hyperactivity or as a subtle illustration of what can be

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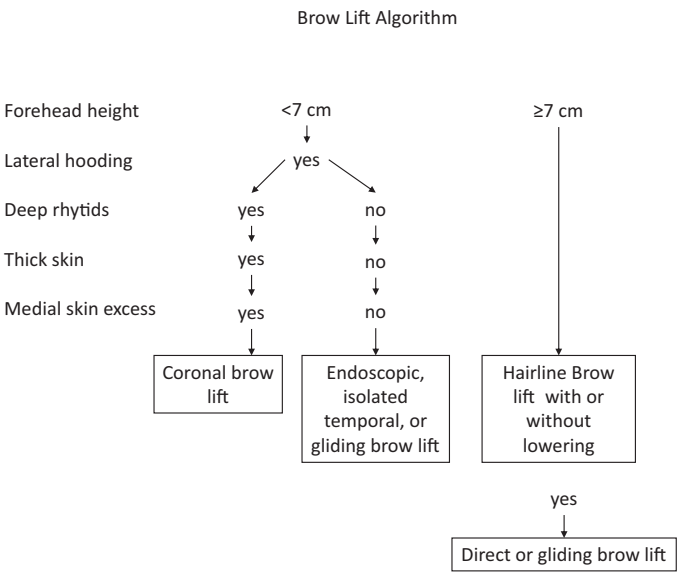

Fig. 5. The authors' algorithm for the correction of brow ptosis.

accomplished surgically. Similar to the endoscopic lift, the brow depressors are targeted and weakened, allowing the frontalis muscle to work relatively unopposed. Typically, the medial brow can be elevated approximately 1 mm, with the lateral brow lifting by as much as 4 mm.[31] Weakening of the frontalis muscle and improvement in horizontal lines can also be accomplished with botulinum toxin. However, this can exacerbate brow ptosis when toxin is used to treat frontalis lines lower on the forehead. Known injection complications include upper eyelid ptosis, exacerbation of brow ptosis, ecchymosis, and diplopia.[32]

Botulinum toxin indications:
- Desire for lateral brow elevation
- Desire for minimally invasive method

Botulinum toxin contraindications:
- Allergy
- Desire for more permanent effect

SUMMARY

In closing, the approach to brow lifting has changed perhaps more than any other facial aesthetic procedure in the past 20 years. Each surgical and nonsurgical approach has unique indications and relative contraindications Patient selection and preoperative assessment of the aforementioned characteristics, including rhytid severity, brow position, potential scarring patterns, surgical history, as well as patient expectations, should be assessed on an individual basis. The authors' algorithm for the correction of brow ptosis is detailed in **Fig. 5**. The authors hope this issue and the guidelines discussed will provide a basis for enhanced surgical results and improved patient satisfaction.

CLINICS CARE POINTS

- Patients with thick, sebaceous skin, deep forehead rhytids, and significant brow ptosis seeking a relatively permanent solution may benefit most from a traditional coronal brow lift.
- The endoscopic brow lift and limited nonendoscopic variations of this procedure have in large part replaced the coronal brow lift because of the limited incisions and less-invasive nature of the procedure.
- The temporal brow-lift indications are ideal for lateral brow elevation in patients with sparse hair and only mild to moderate lateral ptosis. Ancillary techniques can be added to this procedure in order to address medial brow issues, including corrugator and procerus muscle hyperactivity or visibility.
- The hairline brow lift has had a resurgence owing to the recent popularity of facial feminization surgery. It can provide both correction of brow ptosis and forehead shortening.
- A direct brow lift has traditionally been reserved for elderly man with need for medial brow or selective tail elevation, unilateral brow ptosis (such as from facial nerve palsy), a receded hairline, and medical contraindications to general anesthesia. However, Pelle-Ceravolo

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and Angelini[24] have demonstrated excellent results in a wider range of patients.

- Botulinum toxin is a nonsurgical means of improving brow shape while providing subtle brow elevation on a temporary basis. It can also be used as a subtle illustration to the patient of what can be accomplished with surgical correction.

DISCLOSURE

The authors have nothing to disclose.

REFERENCES

1. Flowers RS, Ceydeli A. The open coronal approach to forehead rejuvenation. Clin Plast Surg 2008;35(3):331–51.
2. De la Plaza R, Valiente E, Ma Arroyo J. Supraperiosteal lifting of the upper two thirds of the face. Br J Plast Surg 1991;4(5):325–32.
3. Tirkanits B, Daniel RK. The biplanar forehead lift. Aesthet Plast Surg 1990;14(1):111.
4. Ellenbogen R. Transcoronal eyebrow lift with concomitant upper blepharoplasty. Plast Reconstr Surg 1983;71(4):490–9.
5. Withey S, Waterhouse N, Witherow H. One hundred cases of endoscopic brow lift. Br J Plast Surg 2002;55(1):20–4.
6. Aiache AE. Endoscopic face-lift. Aesthet Plast Surg 1994;18(3):275.
7. del Campo AF. Endoscopic forehead and face-lift: step by step. Open Tech Plast Reconstr Surg 1995;2(2):116–26.
8. Matarasso A, Terino EO. Forehead-brow rhytidoplasty: reassessing the goals. Plast Reconstr Surg 1994;93(7):1378.
9. Kashkouli MB, Beigi B. Endoscopy in the field of oculo-facial plastic surgery. J Curr Ophthalmol 2018;30(2):99–101.
10. Yeatts RP. Current concepts in brow lift surgery. Curr Opin Ophthalmol 1997;8(5):46–50.
11. Malata CM, Abood A. Experience with cortical tunnel fixation in endoscopic brow lift: the "bevel and slide" modification. Int J Surg 2009;7(6):510–5.
12. Guyuron B, Kopal C, Michelow BJ. Stability after endoscopic forehead surgery using single-point fascia fixation. Plast Reconstr Surg 2005;116(7):1988–94.
13. Troilius C. Subperiosteal brow lifts without fixation. Plast Reconstr Surg 2004;114(6):1595–603.
14. Troilius C. A comparison between subgaleal and subperiosteal brow lifts. Plast Reconstr Surg 1999;104(4):1079–90.
15. 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(2). https://doi.org/10.1097/PRS.0B013E3182958B9F.
16. Tabatabai N, Spinelli HM. Limited incision nonendoscopic brow lift. Plast Reconstr Surg 2007;119(5):1563–70.
17. Savetsky IL, Matarasso A. Lateral temporal subcutaneous brow lift: clinical experience and systematic review of the literature. Plast Reconstr Surg Glob Open 2020;8(4). https://doi.org/10.1097/GOX.0000000000002764.
18. Rohrich RJ, Cho MJ. Endoscopic temporal brow lift: surgical indications, technique, and 10-year outcome analysis. Plast Reconstr Surg 2019;144(6):1305–10.
19. Eaves FF, Barton FE, Knize DM, et al. Comparative methods for brow lift. Aesthet Surg J 1997;17(6):397–403.
20. Knize DM. Anatomic concepts for brow lift procedures. Plast Reconstr Surg 2009;124(6):2118–26.
21. Lemke BN, Stasior OG. The anatomy of eyebrow ptosis. Arch Ophthalmol 1982;100(6):981–6.
22. Dayan SH, Perkins SW, Vartanian AJ, et al. The forehead lift: endoscopic versus coronal approaches. Aesthet Plast Surg 2001;25(1):35–9.
23. Puig CM, LaFerriere KA. A retrospective comparison of open and endoscopic brow-lifts. Arch Facial Plast Surg 2002;4(4):221–5.
24. Pelle-Ceravolo M, Angelini M. Transcutaneous brow shaping: a straightforward and precise method to lift and shape the eyebrows. Aesthet Surg J 2017;37(8):863–75.
25. Booth AJ, Murray A, Tyers AG. The direct brow lift: efficacy, complications, and patient satisfaction. Br J Ophthalmol 2004;88(5):688–91.
26. Green JP, Goldberg RA, Shorr N. Eyebrow ptosis. Int Ophthalmol Clin 1997;37(3):97–121.
27. Viterbo F, Auersvald A, O'Daniel TG. Gliding brow lift (GBL): a new concept. Aesthet Plast Surg 2019;43(6):1536–46.
28. Auersvald A, Auersvald LA. Hemostatic net in rhytidoplasty: an efficient and safe method for preventing hematoma in 405 consecutive patients. Aesthet Plast Surg 2014;38(1):1–9.
29. Piovano L, D'Ettorre M. Forehead and brow rejuvenation: definition of a surgical algorithm. Eur J Plast Surg 2018;41(3):285–92.
30. Ilankovan V. Upper face rejuvenation. Int J Oral Maxillofac Surg 2013;42(4):423–31.
31. Kashkouli MB, Amani A, Jamshidian-Tehrani M, et al. Eighteen-point abobotulinum toxin a upper face rejuvenation: an eye plastic perspective on 845 subjects. Ophthal Plast Reconstr Surg 2014;30(3):219–24.
32. Karimi N, Mohsen, Kashkouli B, et al. Techniques of eyebrow lifting: a narrative review. J Ophthalmic Vis Res 2020. https://doi.org/10.18502/jovr.v15i2.6740.

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