

Limited Incision Nonendoscopic Brow Lift

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Background: The authors compared the nonendoscopic brow lift technique to the popular endoscopic procedure to determine whether it offers a less complex and less expensive but equally effective alternative.

Methods: A retrospective comparison of the senior author's experience with the endoscopic brow lift (100 patients; years 1999 to 2004) and the nonendoscopic brow lift (93 patients; years 2002 to 2005) was conducted. Using a three-incision approach for both procedures (one midline and two temporal), endoscopic visualization was used to assist in the last 2 cm of subperiosteal dissection over the superior orbital rim only in the endoscopic technique. In the nonendoscopic technique, this final dissection was performed without the endoscope, and the expected path of the supraorbital and supratrochlear neurovascular bundles through preoperative marking of their meridians was respected. Effective brow elevation, operative times, size of incisions, complications, and overall patient satisfaction were compared between groups.

Results: The authors found no significant difference in average brow elevation between the two brow lift groups (4 mm). However, the nonendoscopic brow lift was completed, on average, 20 minutes faster than the endoscopic brow lift (30 minutes versus 50 minutes) and required a smaller incision than the endoscopic brow lift (2 cm versus 2.5 cm). No nonendoscopic patient experienced permanent complications, but one endoscopic patient developed permanent paresthesias of the forehead secondary to supraorbital/supratrochlear nerve injury. Overall patient satisfaction was equivalent in both groups.

Conclusions: The limited incision nonendoscopic brow lift is a safe and effective alternative to the endoscopic technique. With thorough anatomical knowledge of this region, it offers equivalent brow elevation, shorter operative times, smaller incisions, similarly low complications rates, and patient satisfaction and eliminates the need for costly and cumbersome endoscopic equipment. (*Plast. Reconstr. Surg.* 119: 1563, 2007.)

Eyebrows are perhaps the most expressive part of the face; one can express anger, worry, surprise, and other emotions by the position of his or her brows. Aging and prolonged hyperactivity of the upper facial musculature can result in transverse forehead wrinkles (frontalis muscles), brow ptosis/laxity (corrugator and orbicularis muscles), and glabellar wrinkling (corrugator, orbicularis, and procerus muscles).¹ Thus, the aim of rejuvenation procedures is to improve forehead rhytides, reverse

brow ptosis, reduce or eliminate glabellar creases, and elevate the lateral eyebrow position.²

For nearly a century, many techniques for rejuvenation of the upper third of the face and brow have been described.²⁻⁴ The earliest description of brow lifting in the literature was published by Passot⁵ in 1919; he used elliptical excisions to elevate the brows and diminish crow's feet. Since then, rejuvenation of the aging upper third of the face has undergone evolutionary transformations from the classic open coronal or anterior hairline brow lift to less invasive techniques such as the limited incision brow lift⁶ and the technologically advanced endoscopic brow-lift in the early 1990s.^{7,8}

The promise of the endoscope is smaller incisions, less alopecia, less permanent sensory nerve injury, and provision of a similarly effective brow lift. Unlike the open techniques that rely on a combination of skin excision and soft-tissue-

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Received for publication September 6, 2005; accepted February 10, 2006.

Presented in part at the Northeastern Society of Plastic Surgeons Annual Meeting in Washington, D.C., November of 2005.

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DOI: 10.1097/01.prs.0000256073.49355.fc

pexy, endoscopic techniques rely solely on soft-tissue repositioning. A recent survey of the membership of the American Society of Plastic Surgeons representing 6951 brow lifts revealed that approximately 50 percent were performed endoscopically.⁹ Complication rates were similar and low, with the most frequent complication being alopecia. Interestingly, the endoscopic technique was most often practiced by younger surgeons in larger cities, with the senior surgeons feeling that open techniques were more effective overall and that the endoscopic technique is a “passing fancy.” In a recent study, a 70 percent decline in the number of endoscopic brow lift procedures was reported in a single institution.¹⁰ They attributed the diminished popularity of the endoscopic brow lift to the fact that “other medical and surgical techniques are equally or more effective and predictable; and endoscopic brow lift is ineffective in a majority of patients.”

Numerous authors believe that the endoscopic approach to rejuvenation of the upper face is appropriate for most types of patients except for those with deep senile forehead rhytides, major brow ptosis, high hairlines, or marked asymmetry/facial nerve injury.^{2,10–15} Although the major advantage of the endoscopic technique is that it is minimally invasive, its major disadvantage is that it relies on cumbersome, expensive equipment to perform a very small portion of the actual dissection during a brow lift. This equipment is mainly used to identify and preserve the neurovascular bundles and for corrugator supercilii and procerus muscle removal. This can be further complicated when the field of view is encumbered by blood, debris, and smoke. Other disadvantages of this technique include an inherent learning curve in the procedure and the longer duration of the surgery when compared with alternative methods.¹⁶ We believe that the disadvantages delineated play a prominent role in the decreased popularity of the endoscopic brow lift and explain why it has been labeled as less effective than the coronal brow lift and a “passing fancy.”^{9,10}

In this study, we compare our technique of a minimally invasive, limited incision, nonendoscopic brow lift with the endoscopic procedure to determine whether it offers a less complex but equally effective alternative and one that even surgeons who favor a coronal approach would find acceptable. The nonendoscopic brow lift relies on a thorough familiarity with the anatomy of the upper face and allows for safe dissection in

the subperiosteal plane while providing effective brow elevation and improving transverse and glabellar lines.

PATIENTS AND METHODS

We present a retrospective comparison of the senior author's experience with the endoscopic brow lift (100 patients) performed from 1999 to 2004 and the nonendoscopic brow lift (93 patients) performed from 2002 to 2005. The mean follow-up time was 6 months to 5 years.

Surgical Procedure

Both techniques are similar in that the dissection is performed in the subperiosteal plane with three posthairline incisions (one midline and two temporal). This dissection is taken down over the superior orbital rim and zygomaticofrontal suture anteriorly and to the vertex of the cranium posteriorly. The central dissection is taken down to the radix of the nose and the subperiosteal soft-tissue degloving extends laterally to include the lateral orbital rim. Care is taken not to enter the temporal fossa. This ensures the safety of the temporal branches of the facial nerve. Full release of the forehead flap is obtained without freeing superficial temporal fascia from deep temporal fascia where they are fused together. The dense adhesion of periosteum present along the medial side of the temporal fusion line is released. The periosteum is more aggressively stripped over the orbital rim, lateral to the supraorbital neurovascular bundle and medial to the supratrochlear neurovascular bundle.

Endoscopic visualization is used to assist in the last 2 cm of subperiosteal dissection over the superior orbital rim only in the endoscopic brow lift technique. In the nonendoscopic brow lift technique, the anatomical origins of the supratrochlear and supraorbital neurovascular bundles at the superior orbital rim are marked preoperatively using palpation of a notch or foramen when possible (Fig. 1). When these orbital rim landmarks cannot be palpated, anatomical data are used to map out the most likely location of the origin of the nerve bundles on the rim. Previous anatomical studies variably describe the location of the origins as 16 to 22 mm from midline for the supratrochlear bundle and 24 to 32 mm from midline for the supraorbital bundle.^{11,17–19} The deep branch of the supraorbital nerve usually exits at the supraorbital notch in the orbital rim, but it can also exit bone from a foramen located along a plane perpendicular to the notch and up to approximately 1.5 cm



Fig. 1. Beginning at the midline, the anatomical origins and the parasagittal meridians of the supratrochlear and supraorbital neurovascular bundles, starting at the superior orbital rim, are marked preoperatively using palpation of a notch or foramen. Then, a line is drawn to show the meridian of the desired high point of the eyebrow and the site of fixation within the scalp. The most lateral marking is the temporal line.

superior to the rim.²⁰ Knize's²¹ study of the supraorbital nerve showed that the superficial branch of the nerve runs in the subgaleal/subfrontalis plane, whereas the deep branch runs in the subperiosteal plane approximately 5 to 15 mm medial to the line formed by the temporal crest (Fig. 2). Dissection at the subperiosteal plane preserves the deep branch of the supraorbital nerve, which runs between the galea aponeurotica and the periosteum. In addition, preoperative markings of the anatomical origins of the neurovascular bundles are made using palpation of a notch or foramen and anatomical data combined with a more vertical dissection technique; any aberrant exiting nerves are spared.

With these anatomical parameters in mind, a careful subperiosteal dissection is performed and adequate release of the periosteum along the orbital rim is ensured (Fig. 3). The periosteum is incised approximately 1 cm above the orbital rims in the nonendoscopic brow lift technique.

It is widely accepted that once the frontal periosteum is released and the brow depressor muscle ablated, the newly elevated forehead flap should be maintained in position until its periosteum can

readhere to the frontal bone.¹⁵ The time frame for this process varies anywhere between several days and 12 weeks.²² Thus, fixation methods are used because of their association with the lowest rate of brow ptosis recurrence. Fixation was provided by a number of methods, most recently using resorbable materials including screw/suture and the Coapt Endotine pegs (Coapt Systems, Inc., Palo Alto, Calif.). Standard incision closure is then performed. Each patient is then evaluated for effective brow elevation, operative times, size of incisions, complications, and overall satisfaction.

RESULTS

Both the endoscopic brow lift and the nonendoscopic brow lift techniques provided equally satisfactory brow lifts. There was no significant difference in average brow elevation between the nonendoscopic brow lift and endoscopic brow lift groups (4 mm in both groups) (Figs. 4 through 6). With respect to duration of the procedure, the nonendoscopic brow lift was completed, on average, 20 minutes faster than the endoscopic brow lift (30 minutes versus 50 minutes). The nonendoscopic brow lift technique required a smaller incision size than the endoscopic brow lift (2 cm versus 2.5 cm).

The overall rate of complications for both procedures was low. Although none of the nonendoscopic brow lift patients experienced permanent complications, one endoscopic brow lift patient did develop permanent paresthesias of the forehead secondary to supraorbital/supratrochlear nerve injury. Typical complaints about palpability of the resorbable fixation devices were noted.²³ One patient in our nonendoscopic brow lift series developed visible and palpable granulomas around her Coapt Endotine devices that necessitated removal and curettage of the granulomas and the device remnants 3 months after her original procedure. Patients in both groups were equally satisfied with the outcome of their operation, with follow-up times ranging from 6 months to 5 years.

DISCUSSION

The ideal brow position was described by Westmore in 1974.²⁴ He stated that the medial brow should begin on the same vertical plane as the lateral extent of the nasal ala and the medial canthus, and that it should end laterally at an oblique line from the most lateral point of the nasal ala and the lateral canthus.¹⁶ The edge of the lateral eyebrow should lie slightly above the medial brow and the apex of the brow curve should lie directly

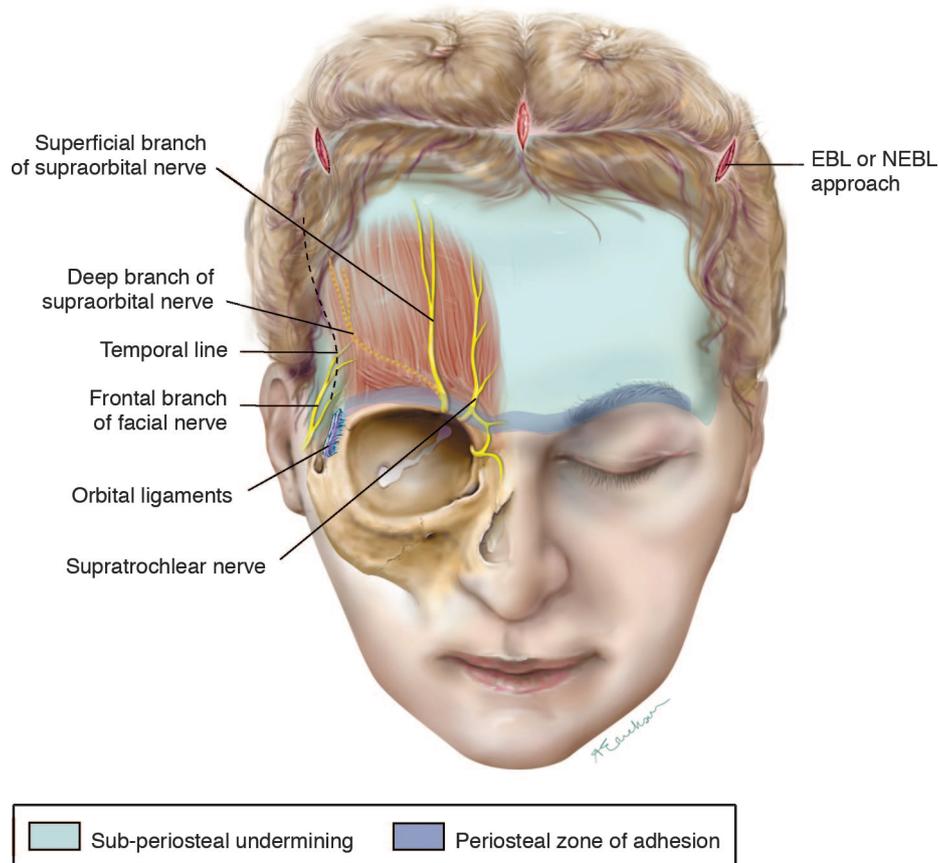


Fig. 2. Surgical anatomy of the supratrochlear and supraorbital neurovascular bundles (EBL, endoscopic brow lift; NEBL, nonendoscopic brow lift).

above that lateral limbus. He also stated that the eyebrow should form a gentle arch whose peak lies



Fig. 3. With the anatomical parameters of the supratrochlear and supraorbital neurovascular bundles in mind, careful subperiosteal dissection is performed and adequate release of the periosteum along the orbital rim is ensured.

at the junction of the medial two-thirds with the lateral one-third and that this peak should ideally lie midway between the lateral aspect of the iris and the lateral canthus.²⁴ Ellenbogen²⁵ further illustrated the spatial relationship of the aesthetic brow to other facial features in 1983. He added that, in women, the eyebrow begins medially at a vertical line drawn perpendicularly through the ala of the nose and that the brow should arch to above the supraorbital rim.

McKinney et al.⁴ analyzed 15 aesthetically pleasing brows and observed that the average distance from the mid pupil to the upper edge of the eyebrow is 2.5 cm and the distance from the upper edge of the eyebrow to the hairline is approximately 5 cm. They stated that if the distance from the mid pupil to the upper edge of the eyebrow is less than 2.5 cm, brow ptosis exists. Knize²⁶ discussed several mechanisms contributing to brow ptosis, including depression of the medial eyebrow from overaction of the brow depressors and descent of the lateral eyebrow from unopposed lateral orbicularis oculi contraction. He stated that



Fig. 4. Preoperative (*left*) and postoperative (*right*) views of patients who underwent the limited incision nonendoscopic brow lift.

these factors need to be modified to elevate the eyebrow and forehead adequately.

In addition to brow ptosis, aging and prolonged hyperactivity of the upper facial musculature can also result in transverse forehead wrinkles and glabellar wrinkling. Thus, the aim of rejuvenation procedures is to improve forehead rhytides, reverse brow ptosis, reduce or eliminate gla-

bellar creases, and elevate the lateral eyebrow position.²⁷

To recreate the aesthetically pleasing brow as described above, several surgical procedures have evolved over the past century. Perhaps the most recent and technologically advanced technique is the endoscopic brow lift. The endoscopic brow lift, because of its “less invasive nature,” enjoyed



Fig. 5. Preoperative (*left*) and postoperative (*right*) views of patients who underwent the limited incision nonendoscopic brow lift.

early excitement and acceptance as an alternative to the coronal brow lift. Over time, surgeons used modifications and variations in incisions, fixation, and extent of dissection without a universally accepted approach ever evolving. More recently, the popularity of the endoscopic brow lift has diminished and even its efficacy has been called into question.¹⁰ Thus, the continued advocacy for al-

ternative brow procedures was noted not only in the scientific literature but also in the lay and commercial literatures. We believe that the interest in the endoscopic brow lift has diminished because of technique shortcomings, equipment expense and problems, longer operative times, and the wide variations in surgeon expertise. However, the diminished interest is not because of



Fig. 6. Preoperative (*left*) and postoperative (*right*) views of patients who underwent the limited incision nonendoscopic brow lift.

inherent shortcomings in the concept of a limited incision brow lift technique.

In this study, we present our technique of a limited incision nonendoscopic brow lift that takes advantage of the principles of minimally invasive surgery without the expense, learning curve, and encumbrance of endoscopic equipment. By using endoscopic brow lift-type incisions to raise the lateral and (if necessary) medial eyebrow, and with a firm knowledge of the anatomical location of crucial forehead structures, the limited incision nonendoscopic brow lift can be performed safely and effectively, with results similar to the endoscopic procedure. More specifically, the nonendoscopic brow lift offers the surgeon a comparable extent of dissection and periosteal release—and allows the protractors of the brow to be addressed—as the endoscopic brow lift. However, in contrast to the endoscopic brow lift, the nonendoscopic brow lift negates the need for cumber-

some and expensive equipment, shortens operative time, and reduces the overall expenses while creating a more user-friendly procedure.

The endoscopic brow lift is limited because it is only appropriate for the treatment of minimal to moderate brow ptosis, glabellar creases, forehead rhytides, and lateral and central brow laxity, whereas the limited incision nonendoscopic brow lift is also able to treat severe cases. With through knowledge of the anatomy of the forehead, we have shown that endoscopic visualization is not necessary to perform a safe and effective brow lift. In fact, many surgeons, including Knize,²⁸ have abandoned the endoscopic brow lift, preferring limited incision approaches to brow rejuvenation often combined with upper blepharoplasty in over 500 patients with up to 8 years' follow-up. Unfortunately, our follow-up is not as extensive. However, with the longevity of results more dependent on plane of dissection and type of fixation than

means of visualization, we have no doubt that our results will be as long-lasting as those obtained through endoscopic means.

CONCLUSIONS

The limited incision nonendoscopic brow lift is a safe and effective alternative to the endoscopic technique. It offers equivalent brow elevation, shorter operative times, smaller incisions, similarly low complications rates, and overall patient satisfaction while eliminating the need for costly and cumbersome endoscopic equipment. It is a simple, quick procedure that does not require any expensive specialized equipment or personnel or extensive training to perform. Armed with thorough knowledge of the anatomy of the region, the average surgeon will be able to obtain consistently good results with the nonendoscopic brow lift.

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DISCLOSURE

Neither of the authors has a financial interest in any of the products, devices, or drugs mentioned in this article.

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