ORIGINAL ARTICLE

Evaluation of the Midforehead Brow-lift Operation

Benjamin Powell, MD; Ahmed Younes, MBBCh; Oren Friedman, MD

Objective: To examine patients who have undergone midforehead brow-lift to assess the resulting brow position, symmetry, and final scar and overall appearance based on objective evaluations by masked plastic surgeons and laypersons.

Methods: Twenty-one patients undergoing midforehead brow-lift in a single surgeon's practice were identified with at least 6 months' postoperative photographic documentation. Information was collected concerning patient demographics, the cause of brow ptosis, and the outcome of surgery. Four independent evaluators, including 2 plastic surgeons and 2 laypersons, were recruited to compare preoperative and postoperative photographs for brow symmetry, elevation, and incision scar and overall appearance.

Results: The midforehead brow-lift was found to offer excellent aesthetic results in all patients, with the mean across all categories being greater than 3.5 on the 4.0-point scale (independent of the reviewer background). The mean overall score was 3.60. No patients received the lowest rating of a poor outcome.

Conclusions: A review of the literature regarding brow-lifts and current practice patterns is provided. We believe that the midforehead brow-lift should hold a prominent place among the current treatments for the aging upper third of the face.

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Author Affiliations: Department of Otorhinolaryngology–Head and Neck Surgery, Mayo Clinic School of Medicine, Rochester, Minnesota (Drs Powell and Younes); and Department of Otorhinolaryngology, University of Pennsylvania, Philadephia (Dr Friedman).

Brow ptosis causes aesthetic and functional problems. Management of the aging upper third of the face requires a sophisticated assessment of the patient, the aesthetic ideals, and the options available for treatment. As a result of the aging process, with the combined effects of gravity, repeated muscle contraction, and the loss of tissue elasticity, the brow and forehead begin to sag and to crowd the upper face. This leads to a tired, aged, and even angry appearance to the face, which does not convey the individual's true emotions. Often, the superolateral visual field also is affected. Brow ptosis often is found in conjunction with excessive furrowing and rhytids of the glabella and the forehead. Because of the repeated action of the frontalis muscle, horizontal forehead creases deepen and can become permanent. Vertical and horizontal glabellar rhytids are attributed to the actions of the corrugator supercilii and the procerus muscles, respectively. These combined effects lead to the cosmetic and functional effects requiring correction. Often, the sagging, excess skin is mistakenly attributed to dermatochalasis only, and a misapplied blepharoplasty can fix the brow in the descended position, exacerbating the true problem. Brow ptosis must be addressed before any attempts to treat the eyelid.

Multiple surgical treatments for rejuvenation of the upper third of the face have been described, including the direct brow, midforehead, coronal forehead, pretrichial forehead, and endoscopic assisted lift approaches[1] (**Figure 1**). Of these, the direct brow-lift is the simplest approach. First described in 1930 by Passot,[2] the disadvantages of this technique include the visible scar and the inability to address the forehead rhytids. Also, a loss of fine upper brow hairs is common, resulting in an abnormally sharp definition of the upper brow margin.[3] The brow-lift technique was subsequently modified to use a midforehead or a coronal incision.[4] During the 1980s and 1990s, the coronal brow-lift arguably became the criterion standard for brow-lift procedures.[5] Although it avoids the visible scar, this approach also has disadvantages. These disadvantages include extensive surgical undermining with the increased risk of hematoma and nerve injury, difficulty in precise contouring of brow position through a distant incision, and distortion of the hairline. These disadvantages are similar for the pretrichial modification except for the hairline dis-

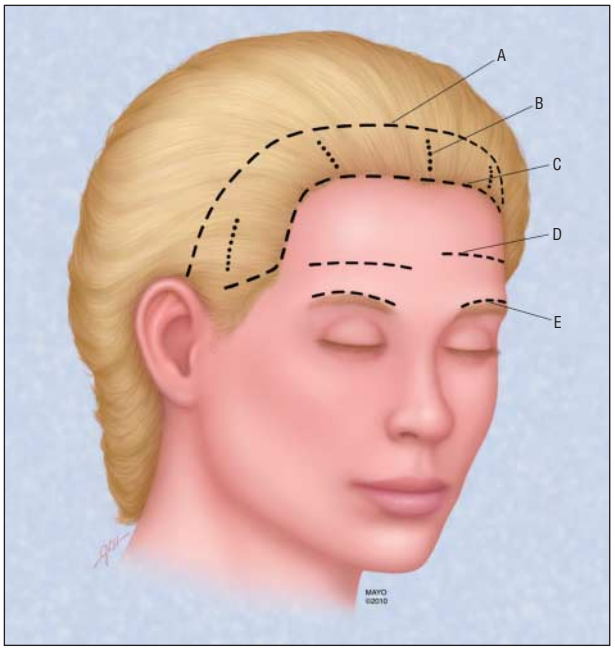

Figure 1. Location of incisions for coronal forehead (A), pretrichal forehead (B), endoscopic assisted (C), and midforehead lifts (D) and direct (E) brow-lift.

tortion. However, a less appealing scar often results when the pretrichial approach is used.[3-5]

The endoscopic technique of brow lifting was described by Vasconez[6] and expanded by Isse[7] and Steinsapir et al.[8] It can be considered the most commonly performed technique among recently trained aesthetic surgeons.[9] Concerns related to this approach include brow asymmetry, brow descent over time, forehead irregularity, and abnormal forehead contour, which may limit overall efficacy and patient satisfaction.[9-11] Also, the surgery itself is more time-consuming than other methods.[12] Other disadvantages of this technique include the inherent learning curve and the specialization of the required equipment.

In contrast, the midforehead approach, originally described by Brennan and Rafaty[13] in 1982, offers several distinct surgical advantages, involves a relatively straightforward technique, and can be used in a wide range of patients. This approach traditionally has been viewed as a procedure for a man with a receding hairline for whom the coronal approach is not possible.[14] The primary limitation always has been incision placement. In contrast to these limited applications, Cook et al[3] suggested in a published report that the midforehead lift was successfully applied in 72 patients, including 52 women, with excellent, long-lasting outcomes in aesthetics and function. They believed the technique addressed all of their needs for precise brow position, exposure for suspension sutures, and access to the forehead depressor muscles for resection if required. They concluded that the disadvantage of the approach, namely, the placement of the incisional scar, was only "theoretical." Other advantages included no distortion of the hairline and minimal risk of hematoma or nerve injury due to the moderate undermining.

Since that time, the midforehead brow-lift continues to be a mainstay for many facial plastic surgeons. To our knowledge, however, the midforehead lift never has been formally evaluated by independent, masked reviewers. Surgeons offering the procedure may believe the results are excellent, but no study attempting to look objectively at those perceptions has been undertaken. Therefore, we assessed the perceptions of plastic surgeons and laypersons regarding the outcomes of midforehead lifting in a consecutive cohort of patients in a single surgeon's practice. We aim to establish an independent evaluation of the aesthetic result and resultant scar to better define the place of the midforehead brow-lift in the upper face rejuvenation algorithm.

METHODS

DATA COLLECTION

A retrospective review of all patients in the practice of the senior author (O.F.) during the past 6 years was undertaken. Inclusion criteria were patients who had undergone bilateral midforehead brow lift, with no history of previous brow or forehead procedures, age older than 18 years, and a minimum of 6 months' follow-up. After Mayo Clinic Institutional Review Board approval, the medical records were analyzed and the patient demographics, cause of ptosis, and outcome of surgery were recorded. Any complications or revision procedures were documented. Standardized preoperative and 6-month postoperative photographs were obtained for all patients and used for this study.

Then, a panel of evaluators was assembled, including 2 board-certified plastic surgeons and 2 laypersons. Each evaluator was independently presented with the preoperative and postoperative photographs of each patient and was asked to grade 4 aspects of the surgical outcome, namely, symmetry, brow elevation, incision scar appearance, and overall appearance. The panel was asked to grade these areas on a scale of poor (1), unsatisfactory (2), satisfactory (3), or very good (4). These data were collected, and statistical analysis was performed.

SURGICAL TECHNIQUE

The brow position is assessed in the upright position with the eyelids, brows, and forehead at complete rest. Brows that rest at or below the supraorbital rim in a female patient or below the rim in a male patient are repositioned. Before any injection, careful marking of the incision sites is performed. The fusiform forehead incisions are placed above the brows, extending from the medial to the lateral margins, with the widest portion over the lateral arch of the brow. They are centered over a naturally occurring skin crease in the forehead and placed at differing heights in the forehead to mimic nature and to hide the scars further. Then, injections are given for vasoconstriction and local anesthesia. The supraorbital and supratrochlear neurovascular bundles are blocked, and the skin from the planned incision to the top of the brow is diffusely infiltrated, extending across the entire forehead.

Then, fusiform skin excisions down to the frontalis muscle are performed, followed by undermining. Sharp dissection superficial to the frontalis muscle is carried out from the inferior incision to the orbicularis oculi muscle. Hemostasis with electrocautery is meticulously performed. No undermining of the upper incision is undertaken. Then, 4-0 polydioxanone sutures are placed using the horizontal mattress and suspension techniques to suspend the orbicularis oculi muscle in connection with the periosteum at the superior aspect of the skin excision site. These sutures are placed to elevate the midportion of the brow and re-create a naturally appearing lateral brow arch.

Figure 2. Preoperative appearance of patient 1.

Figure 3. Nine-month postoperative appearance of patient 1.

A 2-layer closure is achieved using interrupted, subcuticular 5-0 polydioxanone and 5-0 Monocryl sutures (Ethicon, Inc, Somerville, New Jersey) for careful skin eversion; 6-0 fast-absorbing gut suture is applied to align the skin edge. No surgical drains or pressure dressings are used. The incision is coated with antibiotic ointment, and the patient is seen in the clinic on the first postoperative day for any evidence of fluid or blood collection. Any suture material remaining at 1 week postoperatively is removed.

RESULTS

Thirty-eight patients who had undergone a midforehead brow-lift were initially identified, and 21 met the inclusion criteria with 6 months' follow-up and agreed to participate. This group of patients consisted of 19 men and 2 women with a mean age of 69 years (range, 52-90 years). The cause of the brow ptosis was seventh cranial nerve palsy in 2 patients and involutional changes in 19. Dermatochalasis was found in addition to brow ptosis in 6 of the 21 patients for whom upper eyelid blepharoplasty was performed in conjunction with the brow-lift. Regardless of the cause of the ptosis or whether a combined eyelid procedure was performed, the same surgical technique for the forehead lift was performed. No difference was expected or encountered in the postoperative healing or final scar outcome due to the combined procedure or altered facial nerve function. Therefore, it was deemed valid to include these patients in the present study assessing scar acceptability. All patients experienced visual field disturbance before surgery. No intraoperative complications were reported. Mild temporary periorbital edema and ecchymosis occurred postoperatively in all patients and resolved spontaneously without complications. The surgical scar became scarcely noticeable by 6 months, with 1 exception of persistent hyperemia at the incision site after 12 months. Subjective functional relief with improvement in visual obstruction and satisfaction with the aesthetic result were reported by all patients. No revision procedures or scar modifications were undertaken. Examples of preoperative and postoperative appearances are shown in **Figures 2**, **3**, **4**, **5**, **6**, and **7**.

The data obtained from the evaluators across the categories of elevation, symmetry, and scar and overall appearance show excellent cosmetic results (**Figures 8**, **9**, **10**, and **11**). The means for all variables are higher than 3.50 for layperson and surgeon evaluators (**Table 1**).

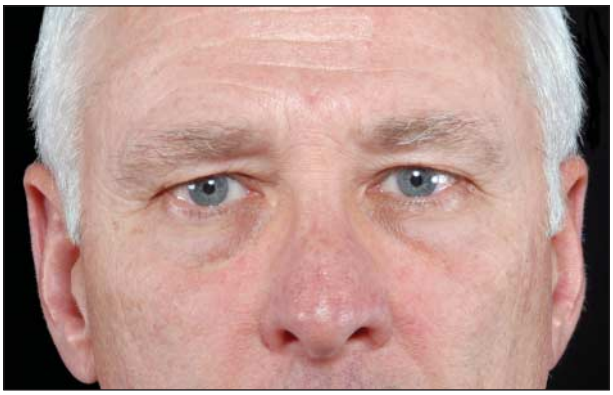

Figure 4. Preoperative appearance of patient 2.

Figure 5. Six-month postoperative appearance of patient 2.

No patient received the lowest rating of a poor (1) outcome. Overall appearance showed particularly high numbers, with the mean reviews greater than or equal to 3.60 and only 1 patient receiving the rating of an unsatisfactory (2) outcome.

COMMENT

Since the early 20th-century descriptions of forehead lifting, surgeons have had many options for rejuvenation of the upper third of the face (**Table 2**). The midforehead brow-lift has maintained a position in the algorithm through the decades as other procedures, such as frontal nerve disruption and musculature excision, have

Figure 6. Preoperative appearance of patient 3.

Figure 7. Seven-month postoperative appearance of patient 3.

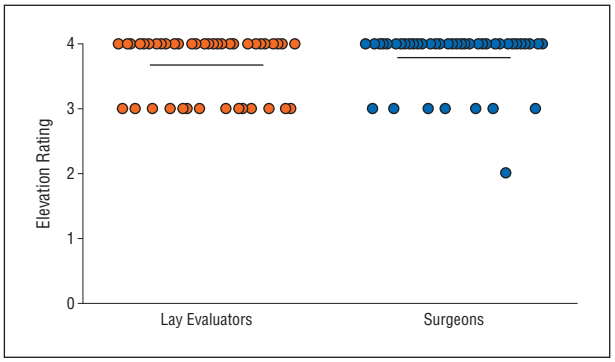

Figure 8. Scatterplot of ratings by layperson and surgeon evaluators for brow elevation. Mean indicated by horizontal line.

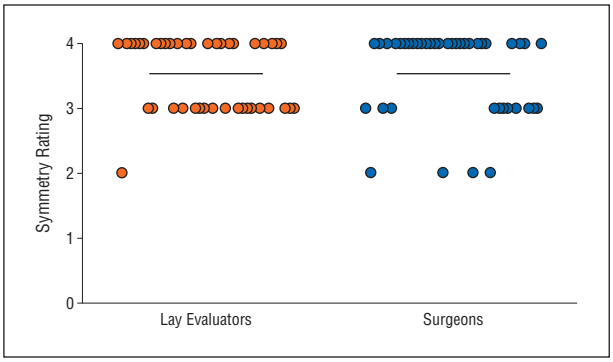

Figure 9. Scatterplot of ratings by layperson and surgeon evaluators for brow symmetry. Mean indicated by horizontal line.

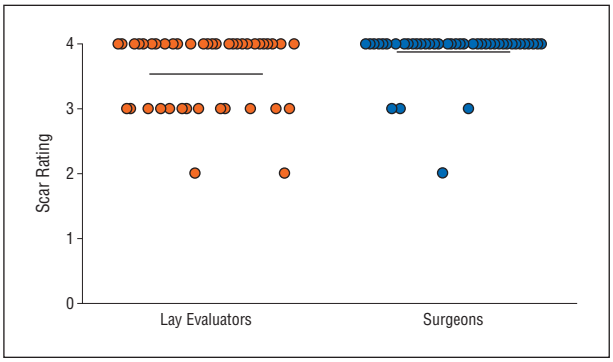

Figure 10. Scatterplot of ratings by layperson and surgeon evaluators for scar appearance. Mean indicated by horizontal line.

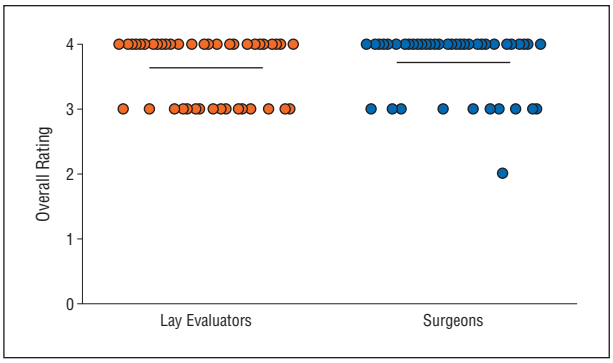

Figure 11. Scatterplot of ratings by layperson and surgeon evaluators for overall appearance. Mean indicated by horizontal line.

decreased in popularity. However, the technique is often relegated to those patients deemed to be unsuitable for coronal incision, endoscopic, or pretrichial approaches, as the limitation of the forehead incision appears to dictate.

In a landmark article published in 1982, Brennan and Rafaty[13] looked at the complications associated with the traditional frontal lift and other approaches and found that midforehead procedures may be ideal in certain patients. They found that the indications of brow ptosis, glabellar ptosis, midforehead frown lines, and overactive frontalis, procerus, or corrugator muscles would be excellent for a midforehead approach. The emphasis only increased in patients with concomitant sparse or high frontal hairlines. The authors found only 2 relative contraindications to a midforehead approach. Those patients without a furrowed forehead are at risk of a prolonged course (ie, several months) of incisional hyperemia with resultant increased anxiety and apprehension. Also, patients with a low, dense frontal hairline are poor candidates because a midforehead resection could abnormally shorten the brow to hairline distance. They found the midforehead incision results to be excellent, with no reported complications, using a simpler procedure than the standard coronal lift.

Another review by Cook et al[3] looked specifically at the wide range of patients suitable for the midforehead browlift. These investigators outlined several advantages, including minimal risk of hematoma and nerve injury with moderate undermining, avoidance of hairline distortion, precise placement of the entire brow length, and access to the glabellar musculature. The disadvantage of the scar

Table 1. Mean Evaluator Ratings for the Appearance Categories

Category	Mean Rating
Scar	
Layperson	3.60
Surgeon	3.88
Symmetry	
Layperson	3.52
Surgeon	3.55
Elevation	
Layperson	3.67
Surgeon	3.79
Overall	
Layperson	3.62
Surgeon	3.71

placement is noted; however, the authors conclude that it "is indeed only theoretical and that, in fact, the scars resulting from this procedure are less objectionable than those from . . . other approaches to elevating the brow."[3(p167)] From these observations, the group began using the midforehead approach exclusively in patients for addressing the ptotic brow. Although no objective data were obtained, they presented a cohort of 72 patients and found the scars to be acceptable to surgeons and patients. Although dermabrasion had been planned at the outset in every patient, it was only performed in 6% of patients. Complications were minor and temporary. The authors concluded that with careful incision placement and closure technique, the midforehead approach offered unparalleled control and access with excellent long-term results in a relatively minor surgical procedure.

The data obtained from the current study support those conclusions. Independent surgeons and laypersons evaluating the resultant brow placement and incisional scar found the outcome satisfactory or excellent in more than 95% of examined patients. No patients received the lowest rating in any category, and all but 1 patient received a rating of satisfactory (3) or very good (4) in overall appearance. The mean rating was similar between evaluator types, with the means of all categories across all evaluators being between 3.52 and 3.88 (**Figure 12**). The procedures were performed with a relatively short operative time and no reported complications. Also, no revision procedures were undertaken. We believe that the midforehead brow-lift could regain a more prominent place in the upper face rejuvenation algorithm in all patients. The relative contraindications would include a lack of any forehead rhytids in which to place the incision or a low, dense hairline, which may become displaced lower by the procedure. Finally, care should be taken in revision cases because patients with prior forehead procedures will have altered blood flow and underlying fibrosis, which could lead to delayed wound healing and a more noticeable scar in the long term. Careful soft tissue handling, precise closure technique, and aggressive postoperative wound follow-up cannot be overemphasized in these cases. Suggestions for further research in this area would include a study comparing a group of patients undergoing a midforehead lift with a control group of an endoscopic brow-lift or a coronal approach, assessing overall appearance, the acceptability of the appearance of scars, and final brow position.

The midforehead brow-lift is a simple, quick, and effective procedure that is easy to perform, has minimal mor-

Table 2. Comparison of the Most Common Brow-lift Procedures

Location	Advantages	Disadvantages
Coronal incision	Hidden scar placement Access to forehead muscles	Extensive undermining with risk of hematoma Hairline elevation Risk of scar alopecia Unacceptable scar in balding patients Less accurate brow placement Long operative time
Pretrichial	No hairline alteration Access to forehead muscles Acceptable scar placement	Extensive undermining with risk of hematoma Hairline distortion Scalp anesthesia posterior to incision Less accurate brow placement Long operative time
Endoscopic	Hidden incisions Access to forehead muscles Minimal alopecia or sensation changes Rapid recovery period	Expensive equipment Technically challenging Extensive undermining required Less accurate brow placement Substantial learning curve Long-term results unknown
Midforehead	Direct control of brow position Precise sculpting of entire brow length Minimal risk to forehead innervation Access to forehead muscles Technically easy and fast to perform Limited undermining No hairline distortion	Scar visibility Shortening of the forehead
Direct brow	Direct control of brow position Minimal risk to forehead innervation Technically easy and fast to perform Limited undermining	Scar visibility Brow line sharpening and irregularity Limited access to medial brow Shortening of the forehead Brow may descend over time Leaves forehead rhytids undressed

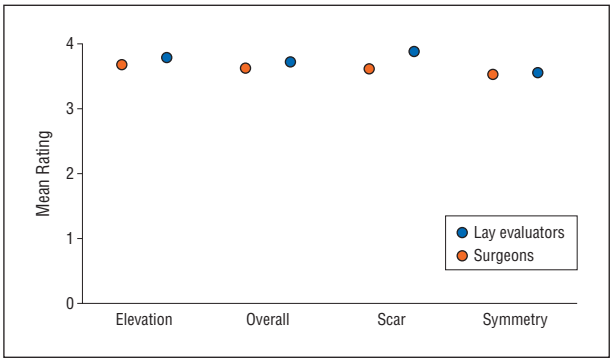

Figure 12. Comparison of means of all tested categories.

bidity, and allows the surgeon strong control of the degree of brow elevation and postoperative shaping of the brow. The objective data reported herein support our subjective sense regarding the midforehead brow-lift. Thorough preoperative planning and careful placement of the incision in a natural skin crease can result in a well-concealed scar with excellent aesthetic results. We believe this study objectively supports our previous subjective belief that the midforehead brow-lift provides excellent functional and aesthetic outcomes. On the basis of these data, we will continue to offer the procedure to our patients as an excellent choice for forehead rejuvenation.

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Correspondence: Oren Friedman, MD, Department of Otorhinolaryngology, University of Pennsylvania, 5 Silverstein, 3400 Spruce St, Philadelphia, PA 19104 (oren.friedman@uphs.upenn.edu).
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