Minimally Invasive Brow Suspension for Facial Paralysis

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Objective: To report a new technique for unilateral brow suspension for facial paralysis that is minimally invasive, limits supraciliary scar formation, does not require specialized endoscopic equipment or expertise, and has proved to be equal to direct brow suspension in durability and symmetry.


Setting: Metropolitan tertiary care center.

Patients: Patients with head and neck tumors and brow ptosis caused by facial nerve paralysis.

Main Outcome Measure: The results of the procedure were determined using the following 3-tier rating system: outstanding (excellent elevation and symmetry); acceptable (good elevation and fair symmetry); and unacceptable (loss of elevation).

Results: The results were considered outstanding in 12 patients, acceptable in 9 patients, and unacceptable in only 1 patient. One patient developed a hematoma, and 1 patient required a secondary adjustment.

Conclusions: The technique has proved to be superior to standard brow suspension procedures with regard to scar formation and equal with respect to facial symmetry and suspension. These results have caused us to abandon direct brow suspension and to use this minimally invasive method in all cases of brow ptosis due to facial paralysis.

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Brow ptosis due to unilateral facial paralysis is most commonly corrected with a direct brow lift. Though very effective in correcting the ptosis, the direct brow lift often results in a noticeable scar immediately above the eyebrow. A supraciliary brow scar can be avoided with an endoscopic brow suspension; however, compared with a direct brow lift, this procedure requires greater technical expertise with specialized endoscopic equipment, increased operating room time, and decreased suspension durability and symmetry. Botulinum toxin injection, a noninvasive technique, has been used with limited success. Several injections are needed over the course of a year, and the elevation and precision of the injections are unpredictable. As a result, we have developed a technique for unilateral brow suspension that is performed in an outpatient setting, is minimally invasive (thereby limiting scar formation), and does not require specialized endoscopic equipment or expertise. This technique has proved to be equal to direct brow suspension in durability and symmetry. This minimally invasive approach also minimizes potential complications of other techniques such as electrical burn, alopecia, necrosis, inflammation, edema, and seroma formation.

METHODS

STUDY PROCEDURE AND PARTICIPANTS

A retrospective analysis chart review was performed. Postoperative patient photographs were obtained and evaluated after surgery using a 3-tiered grading system described by the 3 primary authors (P.D.C., D.H.H., and J.M.). Each patient had at least 12 months of follow-up, with the longest follow-up being 24 months and the average being 16.5 months. As no matched therapeutic control was used in our study, the grading system was based on a comparison of the elevated (paralyzed) brow to the normal (contralateral) side using the postoperative photographs. The 3-tier grading system stratified the results as outstanding, acceptable, or unacceptable with respect to brow elevation and...
with respect to brow contour symmetry in comparison to the contralateral side. All photographs were taken with the patient at rest with respect to facial movement. An outstanding result was defined as an equal level of elevation of the brow coupled with closely matched brow contour symmetry in comparison to the contralateral (normal) brow. An acceptable result indicated nearly equal (within 0.5 cm) maximum elevation in conjunction with closely matched contour symmetry or equal elevation with “fair” contour symmetry relative to the contralateral brow. Unacceptable results were defined as a variance in elevation exceeding 0.5 cm and/or a gross lack of contour symmetry with the contralateral side. Grading was conducted by the primary surgeon (P.D.C.) and the coauthors based on a comparison of the corrected brow to the normal brow on postoperative photographs. Although evaluation of brow elevation was relatively objective, defining contour symmetry remained a subjective element of the study.

**SURGICAL TECHNIQUE**

The technique of minimally invasive brow suspension is initiated by marking the patient with a pen while he or she is sitting up to establish the necessary degree of elevation. Intraoperatively, the technique commences with 3 horizontal “stab” incisions within the hair-bearing portion of the ptotic brow using a No. 15 blade scalpel. Each incision is approximately 5 to 8 mm in width, and its depth is carried down to the level of the frontal muscle. The incisions are positioned at the medial and lateral aspects of the brow and then centrally over the mid-point of the brow (Figure 1). After the brow incisions are made, 3 vertical incisions that are perpendicular to the direction of the brow are made down to the level of the skull, just posterior to the hairline (Figure 1). They can be made significantly posterior to the hairline in patients who have frontal balding or recession, and they are larger (approximately 1-2 cm) than those on the brow. At this point, a Freer elevator or a malleable periosteal elevator can be used to raise the tissue of the forehead off the frontal bone. The dissection is carried down to the level of the supraorbital rim in a blind fashion. During the elevation, the surgeon must continue to palpate the supraorbital notch to avoid injury to the supraorbital nerve and vascular structures that pass through that area. Dissection is carried along underneath the hair-bearing portion of the brow, but not to the level of the orbital rim. Once this tissue has been fully elevated, a hemostat can be inserted through the brow incision to perforate the frontal muscle and enter the subcranial space on the surface of the frontal bone. A 4-0 clear nylon suture can be passed through the frontal muscle and the fascia in the brow region. Care must be taken to avoid including subcutaneous tissue in this stitch to prevent unsightly puckering of the brow incisions. A Hewson suture retriever (Figure 2) can then be inserted through the scalp incision after being appropriately bent in a curved fashion so that it can exit through the previously described brow incision (Figure 3). With the Hewson suture retriever, which has been passed along the undersurface of the skin of the forehead, the 4-0 clear nylon suture can then be pulled into the brow incision site, underneath the pericranium, and out through the previously described superior scalp incisions (Figure 4). This procedure is then repeated for the other 2 brow incisions. Once all 3 sutures are in place, tension can be applied individually to achieve the appropriate level of elevation and the correct contour of the brow. This is most effectively achieved by using hemostats and clipping the 4-0 clear nylon suture to surgical drapes at the head of the bed. Once adequate position is achieved with all 3 sutures, individual sutures can be released and then tied into place after the 4-0 nylon has passed through the anterior edge of the exposed galea-pericranium of the scalp incision site. This suturing of the brow tissue via the 4-0 nylon subcranial suture to the pericranium effectively stabilizes the elevated brow on a long-term basis. The technique is then repeated for the remaining sutures individually. It must be stressed that the level of the brow must be elevated approximately 15% to 20% above

![Figure 1. Location of brow and scalp incisions before soft tissue elevation off the frontal bone.](image1)

![Figure 2. Hewson suture retriever. A disposable flexible tool used in orthopedic and laparoscopic surgical procedures.](image2)

![Figure 3. The Hewson suture retriever is tunneled beneath the pericranium, through the brow incision.](image3)
the normal side, with the patient in recumbent position (Figure 5). Finally, any puckering of the skin around the eyebrow stab wounds must be corrected by careful undermining. The undermining will relieve the puckering, but should not be aggressive enough to cut the 4-0 nylon suture. The brow incisions are then closed with several interrupted 6-0 nylon sutures. The scalp incisions are closed as a single layer with staples. A single 14-gauge angiocatheter is then passed through the scalp tissue, preferably in its hair-bearing area, and inserted in the subcranial space. The stylette is then removed, and the flexible angiocatheter is allowed to remain as a drain until the next morning. The patient's dressing consists of a head wrap, with sufficient padding around the angiocatheter hub so as not to allow pressure by the hub on the surface of the scalp. The angiocatheter allows egress of fluid from the subcranial space during the immediate postoperative space and is uniformly removed the next day. After dressing removal on postoperative day 1, an additional tight turban dressing is applied for an additional 24 to 48 hours.

**RESULTS**

The technique of minimally invasive brow suspension has been performed on 23 patients over the past 3 years, with results that are equal or superior to those in our experience with the direct brow lift with respect to symmetry and durability. The results have proved to be uniformly superior in the prevention of a supraciliary brow scar (Figure 6). The results were considered outstanding in 13 patients, acceptable in 9 patients, and unacceptable in 1 patient. A hematoma developed in 1 patient. Three other patients required a secondary adjustment for puckering at the brow incision site. The connective tissue causing the defect was lysed without damaging the fixation, and the results in all 3 patients were ultimately reclassified as outstanding (n=2) or acceptable (n=1). The failure to achieve a grade of outstanding in the 9 cases with acceptable results was based on a lack of contour symmetry (n=6) or on inadequate brow elevation (n=3). The 1 unacceptable outcome was the result of a failure in both brow elevation and achievement of contour symmetry.

**COMMENT**

A number of direct and endoscopic techniques have been described for the permanent elevation of the brow after facial paralysis. Because no technique has proved to be ideal, there is often a visible postoperative scar or a need for specialized operative equipment.3,7,11 The development of the minimally invasive technique described herein attempts to address both of these problems. After a period of evaluation and development, we believe that we have arrived at a technique that avoids large visible scars, yet limits the need for specialized equipment. Furthermore, the technique is relatively straightforward, falling between the technically simple direct brow suspension and the technically more complex unilateral endoscopic brow suspension with respect to the required level of surgical skill.

Our experience over the past few years has identified several problems that are specific to this method of brow suspension. First, care must be taken to place the sutures in the galea-frontalis alone, without including subcutaneous fat or dermis. If tissues other than those of the galea-frontalis are incorporated with the sutures, a visible pucker will result at that site. This unsightly deformity of the brow is relatively easy to correct, but it can be prevented by undermining the tissues over the location of the galea-frontalis surrounding the suture placement site before placing the traction suture. This action releases the overlying fat and dermis from their connection with the underlying galea-frontalis, thereby minimizing traction on the skin by the suspension suture. Second, 2 suspension sutures, instead of 3, were used in the initial application of this technique. Although 2 sutures proved to be adequate in achieving brow elevation, they were not adequate in matching the brow contour of the corrected side to that of the normal side. As a result, we exclusively use separate medial, lateral, and central suspension sutures in all cases. This method has allowed us
to achieve much better “fine control” over brow contour symmetry.

CONCLUSIONS

The results of the minimally invasive brow suspension technique have proved to be equal to direct brow suspension with respect to elevation and contour symmetry and uniformly superior with respect to scar formation. In comparison to endoscopic brow suspension, we believe that this technique requires less time and equipment, while allowing greater fine control over contour symmetry. Also, a reliable level of elevation can be achieved in the majority of cases with this technique, while matching contour symmetry of the corrected brow with the contralateral brow is more difficult. The most important factors in achieving contour symmetry are experience with the technique and the use of 3 separate brow suspension sutures. We now use this minimally invasive method in all cases of brow ptosis due to facial paralysis as well as in select cases involving patients with congenital or senile bilateral brow ptosis who desire aesthetic improvement.

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REFERENCES