

Comparison Among Three Different Fixation Techniques in Temporal Brow Lift Surgery

Michele Pascali, MD,* Anna Avantaggiato, MD,* Ilaria Bocchini, MD,†
 Francesco Carinci, MD,‡ and Valerio Cervelli, MD§

Introduction: The eyebrow lifting with temporal approach is an increasing widespread technique. Many surgical procedures are described, but the long-term stability is dependent on the effectiveness in the fixation of elevated tissues. The authors compared 3 different fixation techniques in temporal brow lift.

Methods: Forty-five consecutive patients aged between 33 and 70 underwent brow lift surgery with temporal approach. Patients were divided into 3 groups; in group 1, anchorage was performed with Endotine Ribbon, group 2 with a Mersilene mesh, and group 3 with a Prolene suture. The amount of brow elevation was assessed comparing the distance between interpupillar line and superior eyebrow hairline, measured at the midpupil and at the lateral and medial canthal angle. The follow-up was 1 year.

Results: All patients had a pleasant improvement in brow shape. The average initial brow position was 19.84 mm near the head of the eyebrow area, 20.74 mm at the body, and 19.57 mm in the region of the tail. A progressive recovery and a partial relapse regarding the eyebrow body (23.88 mm at 6 months and 23.02 mm at 1 year) occurred, but overall for the lateral region, it passed from 27.53 mm at 6 months to 25.80 mm after a 12-month follow-up. Final brow position was dependent upon surgical technique used in fixation.

Discussion: Different options in brow elevation and stabilization affect the final shape and position of the brows. From the statistical analysis, mesh suspension provided the best results in terms of long-lasting stability.

Level of evidence: Therapeutic III

Key Words: Brow ptosis, brow lift, brow fixation, temporal eyebrow lifting, Endotine, mesh

(*J Craniofac Surg* 2015;26: 906–910)

From the *II Level Master of Plastic and Esthetic Surgery of the Facial District; †Specialization School in Plastic and Reconstructive Surgery, University of Rome Tor Vergata, Rome; ‡Department of Morphology, Surgery and Experimental Medicine, University of Ferrara, Ferrara, Italy; and §Department of Plastic and Reconstructive Surgery, University of Rome Tor Vergata, Rome, Italy.

Received November 21, 2014.

Accepted for publication January 21, 2015.

Address correspondence and reprint requests to Francesco Carinci, MD, Department of Morphology, Surgery and Experimental Medicine, Section of Translational Medicine, University of Ferrara, Via Luigi Borsari, 4644100 Ferrara, Italy; E-mail: crc@unife.it

The authors report no conflicts of interest.

All the authors participated in the ideation and writing of this article, giving substantial contributions to conception and design, acquisition of data, their analysis and interpretation, drafting, and revision of the manuscript.

Level of evidence: Therapeutic III

Copyright © 2015 by Mutaz B. Habal, MD

ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000001603

Eyebrows and mouth are the focal points in the dynamic face perception not only for their functional roles but because these regions carry most information about the facial configuration and recognition.^{1,2} Eyebrow ptosis is influenced by genetic physiognomics and can be considered the earliest manifestation of the aging forehead; in fact, it gives the face a tired look and enhances the incoming deformities of the upper eyelids. After the age of 50, an observational study evidenced a prevalence of 60.8% in eyebrow ptosis.³ Anatomic and histologic studies confirmed that the mechanism producing ptosis is more relevant on the lateral eyebrow.^{4,5} Various techniques have been described for periorbital rejuvenation and correction of ptotic brow, including the coronal brow lift, the endoscopic brow lift, the anterior hairline forehead plasty, and the temporal, transpalpebral, and direct brow lift.^{6,7} Many differences can be observed in the type of incision and in the plane of dissection, but all of them have a common denominator: an unpredictable degree of relapse. Recurrent eyebrow ptosis mostly occurs because of fixation failure caused by using too weak materials.⁸ The particular anatomy of the temporal region can be seen as a boundary between 2 different embryological regions depending on the V and VII cranial nerves, respectively. Thus, the adherence between these 2 fascial systems, which have been researched and created by brow surgery, has the aim to anchor the more weak mimetic facial muscles, depending on VII nerve, to the deep fascial system that envelopes skeletal muscles innervated by the deep temporal nerves that are branches of the mandibular division of the trigeminal nerve.

The aim of this article is to compare 3 different fixation techniques for the temporal brow lift in achieving long-lasting results: the temporoparietalis imbrication and fixation with permanent suture, the use of a slow absorbable ribbon-shaped suspension device, and the fixation via a non-absorbable mesh. The challenge is to understand the potential differences in long-term stability and the effectiveness in the lifting of different segments on the basis of presurgical diagnosis and treatment goals.

MATERIALS AND METHODS

Materials

The following commonly used synthetic brow-suspension materials were purchased and consecutively used:

Endotine Ribbon (Coapt Systems, Inc., Palo Alto, CA), an absorbable device intended for soft tissue suspension anchoring by its multi-point technology, made of LactoSorb (Walter Lorenz Surgical, Jacksonville, FL) consisting in 82% poly-L-lactic acid and 18% polyglycolic acid.

Woven polyester mesh (Mersilene mesh; Ethicon Johnson & Johnson Medical Ltd., New Brunswick, NJ), a macro-porous structure constructed by ~15 filaments (each with a diameter of 15 μ m) woven into a mesh that forms oval-shaped pores, long axis = 1.40 ± 0.05 mm and short-axis = 0.75 ± 0.02 mm with an overall thickness = 0.26 mm, consisting in polyethylene terephthalate (PET).



FIGURE 1. Intraoperative photograph of the Endotine Ribbon technique. The ribbon is shortened to 5 to 6 cm. It is set with multiple tines outward and anchored to the deep temporal fascia with two or three 4-0 polydioxanone mattress sutures.

4-0 monofilament polypropylene (Prolene; Ethicon Johnson & Johnson Medical), a smooth monofilament with a diameter of $201 \pm 2 \mu\text{m}$.

4-0 monofilament polydioxanone (PDS), a monofilament suture (Ethicon Johnson & Johnson Medical) able to retain its strength for long periods and then is absorbed by simple hydrolysis. This suture was used to fix the cephalic end of the ribbon or the mesh to the deep temporal fascia.

Patients

A retrospective study based on consecutive 45 healthy patients undergoing bilateral temporal brow lift surgery, associated to upper blepharoplasty, between January 2011 and December 2012, was performed. The group consisted of 24 women and 21 men. The average age was 49 with a minimum of 33 and a maximum of 70. These patients belong to 3 groups (15 per group) on the basis of the brow suspension system. In the first surgical group, the anchorage was performed using the Endotine Ribbon, successively (group 2) with the Mersilene mesh, and finally (group 3) with a Prolene suture.

All procedures were performed by the same surgeon (M.P.). Informed consent was acquired from each patient. Institutional Review Board approval was not acquired because the research was retrospective and involved collection of existing data. However, the principles outlined in the Declaration of Helsinki were followed.

Presurgical examination was performed with the patient in an upright position, with closed eyes and the frontalis muscle fully relaxed to assess the preoperative degree of brow ptosis.⁹ Exclusion criteria were the excess of hyperactivity of corrugator supercilii or procerus muscles needing excision that was not performed. The upper blepharoplasty was simultaneously performed, and the patients were preoperatively marked for adequate eyelid skin excision while the brow was manually corrected by the surgeon. The postoperative follow-up was 12 months.

Surgical Technique

After surgical preparation and local infiltration of 1% lidocaine with 1:500,000 adrenaline, bitemporal 3- to 4-cm incisions were placed 2 cm behind, parallel to the hairline. Through the temporal incision, dissection was carried out superficially to the deep temporal fascia and extended up to the temporal crest and downwards along the superior and lateral orbital rim and the anterior third of the zygomatic arch. The conjoined fascia was taken down lateral to medial and superior to inferior under direct visualization. Thus, a frontotemporal flap was created through a combination of subperiosteal and the superficialis temporalis fascia dissections, which changes along the temporal crest. This entire structure was released to obtain optimal elevation of the lateral brow. Then, an upper blepharoplasty was performed at the same time. The brow was then lifted manually to verify that its orbital attachments were completely released.¹⁰ In fact, with each technique, it is critical that the orbicularis oculi muscle is divided just above the lateral canthal



FIGURE 2. A, Intraoperative photographs showing the surgical technique with Mersilene mesh. The mesh is cut with a width of 3 cm. B, A subgaleal tunnel is created and the mesh is placed into the dissected tunnel. C, The caudal end of the mesh is sutured to the upper margin of the orbicularis oculi muscle with 4-0 polydioxanone suture. D, The cephalic end of the mesh is fixed to the deep temporal fascia using 4-0 running polydioxanone suture.

level to allow a better mobilization of the eyebrow in the lateral region.

When the brow lift with Endotine Ribbon was performed, its full length of 15.5 cm was shortened to 5 to 6 cm, thus obtaining 2 devices that can be used for both sides. Then, the shortened ribbon was set and anchored by its holes to the deep temporal fascia with 4-0 polydioxanone mattress sutures (Fig. 1). The lateral temporal flap was pulled along a traction vector of 45 degrees, and the height and shape of the brow were evaluated. When the desired lifting was achieved, digital pressure was used to ensure penetration of the temporalis superficialis fascia on the ribbon tines.

In the brow lift using Mersilene mesh fixation (Fig. 2A–D), the superior orbital rim was exposed a little more extensively; thus, the supraorbital nerve was identified, where it arises from the frontal bone, and preserved.⁸ Then, a mesh strap, 3 cm in width, was placed into the dissected tunnel. The caudal end of the mesh was sutured to the undersurface of the superior margin of the orbicularis oculi muscle. Subsequently, an ideal eyebrow position was obtained by traction of the cephalic end of the mesh suspender. At this point, it is also possible to modify the eyebrow body and tail shape, changing and modulating the mesh tension more laterally or medially. Finally, the cephalic end of the mesh was fixed to the deep temporal fascia using 4-0 running polydioxanone suture.

When the suture technique was chosen, a lateral temporoparietalis fascial free of tension flap was obtained and a suspension fixation was performed by means of a superficial temporal fascia/deep temporal fascia imbrication with non-resorbable 4-0 Prolene stitches (Fig. 3A,B).¹¹ No resection or very limited removal of scalp excess was performed in all 3 techniques, avoiding any superficial tension that otherwise appeared uniformly distributed along the entire length of the flap. The scalp incisions were closed either with a running 4-0 Vicryl suture or with staples, and a moderately compressive dressing is applied to the forehead and temporal region and removed after 24 hours.

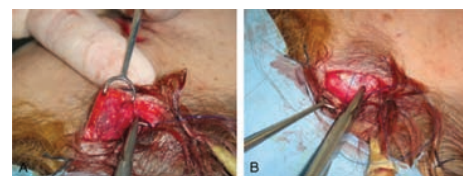


FIGURE 3. Intraoperative photographs of the non-resorbable suture technique. Suspension fixation is performed by means of (A) superficial temporal fascia/(B) deep temporal fascia imbrication with non-resorbable 4-0 Prolene stitches.



FIGURE 4. Measurements were performed between interpupillar line and upper brow at the midpupil and medial and lateral canthi.

Photometric Evaluation

Full-size, 1:1 standardized photographs (Frankfurt horizontal plane) were acquired of each patient before surgery. Position, facial expression, focal distance, and camera settings were standardized. Postoperatively, additional sets of photographs were taken 30 days, 6 months, and 1 year after surgery. All photographs were sized with Adobe Photoshop CC (Adobe Systems Inc., San Jose, CA) to maintain initial proportions. Linear measurements were performed with Adobe Illustrator CC after drawing an interpupillary line. The distance (mm) between this line and the upper edge of each eyebrow were measured in 3 points: medial canthus, pupil, and lateral canthus (Fig. 4).

Statistical Analysis

All data were reported in a Microsoft Excel file (Microsoft, Redmond, WA), and SPSS (SPSS Inc., Chicago, IL) was used to analyze the data. A paired sample test was performed between each surgical group to detect eyebrow position (ie, between pre- and postsurgical procedure, between postsurgical procedure and 6 months of follow-up, and between 6 months and 1 year of follow-up).

RESULTS

All the patients obtained a lateral brow elevation that was 9.83 mm on average in the postoperative period. During the follow-up was observed a reduction in this correction that decreased to 7.96 mm at 6 months and to 6.37 mm at 1 year. Patients were satisfied with the results, and no sensible complications, including permanent alopecia, were observed. Table 1 reports the data of 45 patients (90 eyebrows): preoperatively, 1 month after surgery, after 6 months, and 1 year after surgery. By comparing ribbon versus sutures, the first permits a greater elevation both in the entire brow length and

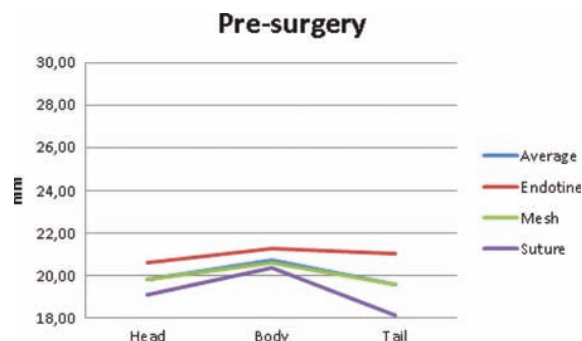


FIGURE 5. Preoperative measurements of eyebrow position. All patients had a low brow position both in the central and in the lateral segment.

over time. The comparison mesh versus suture gave rise to a better performance of the mesh not only on lateral but also on central eyebrow during the follow-up. Between ribbon and mesh, the ribbon is better in the lateral brow in the first 6 months, whereas after 1 year no significant differences were appreciable.

The average initial brow position was 19.84 mm in the region near the head of the eyebrow, 20.74 mm at the body, and 19.57 mm in the tail region (Fig. 5).

One month after surgery, the medial zone has not changed, whereas the middle and the tail were more and more affected by the 3 techniques in a similar amount (Fig. 6). The mean values were 19.92 mm for the medial portion, 24.84 mm for the central, and 29.41 mm for the lateral part near the brow tail.

The same measurements were performed after 6 months (Fig. 7) and after 1 year (Fig. 8). It can be observed that there is a progressive recovery of the initial overcorrection and a relapse regarding the lateral region which passes from 27.53 mm at 6 months to 25.80 mm at 12 months after surgery, whereas the eyebrow body changes from 23.88 mm at 6 months to 23.02 mm at 1 year. The different surgical techniques affected the results. Statistically significant differences were observed for the central brow. Finally, the initial and final measurements in the different techniques were compared and thus the brow elevation in terms of absolute value is evidenced (Fig. 9).

The patient in Figures 10A and B was concerned about her sad appearance, and she underwent the treatment with the Endotine Ribbon. The visible improvement is the result of both brow lift and blepharoplasty procedures. The patient in Figures 11A and B was

TABLE 1. Data of 45 Patients (90 Eyebrows) Preoperatively, 1 Month After Surgery, After 6 Months, and 1 Year After Surgery

	Average	Ribbon	Mesh	Suture	Ribbon vs. Mesh	Ribbon vs. Suture	Mesh vs. Suture
Presurgery							
Medial	19.84 ± 1.82	20.59 ± 1.92	19.82 ± 1.73	19.12 ± 1.54	N.S.	P = 0.002	N.S.
Central	20.75 ± 1.64	21.26 ± 1.71	20.59 ± 1.59	20.38 ± 1.54	N.S.	P = 0.040	N.S.
Lateral	19.57 ± 2.37	21.05 ± 2.4	19.55 ± 2.43	18.13 ± 1.11	P = 0.020	P = 0.001	P = 0.005
Postsurgery							
Medial	19.92 ± 1.81	20.68 ± 1.84	19.9 ± 1.73	19.18 ± 1.57	N.S.	P = 0.001	N.S.
Central	24.84 ± 1.81	24.36 ± 1.97	25.46 ± 1.33	24.7 ± 1.94	P = 0.014	N.S.	N.S.
Lateral	29.41 ± 1.46	29.8 ± 1.96	29.69 ± 1.05	28.74 ± 0.94	N.S.	P = 0.01	P = 0.001
After 6 mo							
Medial	19.88 ± 1.79	20.59 ± 1.84	19.88 ± 1.73	19.17 ± 1.54	N.S.	P = 0.002	N.S.
Central	23.88 ± 1.81	23.77 ± 1.94	24.69 ± 1.41	23.2 ± 1.76	P = 0.041	N.S.	P = 0.001
Lateral	27.53 ± 2.03	28.78 ± 2.00	28.33 ± 0.94	25.49 ± 1.08	N.S.	P = 0.001	P = 0.001
After 1 yr							
Medial	19.77 ± 1.77	20.36 ± 1.88	19.78 ± 1.74	19.16 ± 1.52	N.S.	P = 0.009	N.S.
Central	23.02 ± 1.47	23.17 ± 1.37	23.67 ± 1.28	22.24 ± 1.44	N.S.	P = 0.013	P = 0.001
Lateral	25.8 ± 2.5	27.21 ± 2.13	27.04 ± 1.06	23.14 ± 1.59	N.S.	P = 0.001	P = 0.001

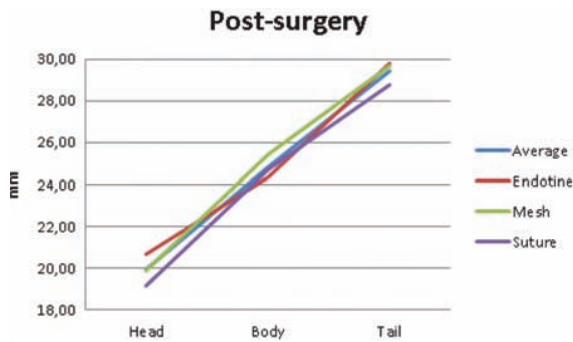


FIGURE 6. Measurements performed in the postoperative period (about 1 month later). All the brows were lifted to reach a quite similar position independently from the initial height and shape.

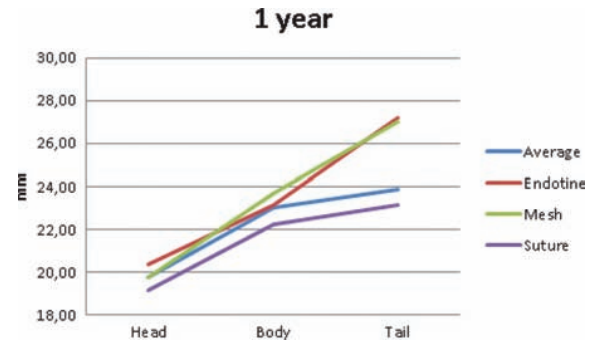


FIGURE 8. One year after surgery, a further descent of the brow tail in the "suture" group but even in the other groups affects the average trend.

treated with the Mersilene mesh technique and reached a good correction in brow position and lid redundancy; moreover, brow asymmetry was simultaneously corrected. Figures 12A and B illustrates the initial position and the outcome 1 year later of a brow lift treatment with the temporal suture fixation. This woman was upset for her too pronounced arch-shaped brows not reflecting the aesthetic parameters, so she decided for surgical remodeling.

DISCUSSION

The described techniques follow the principles of the temporal brow lift but differ regarding the type of materials used and the type of fixation. Many authors have described their experience with the forehead and brow lift with the Endotine Forehead (Coapt Systems, Inc., Palo Alto, CA) fixation device.^{12,13} However, many surgeons felt that although the amount of central lift achieved was satisfactory, lateral brow lift could not be obtained by means of this device.^{14,15} This problem is particularly evident in patients with severe brow ptosis. For this reason, the surgical technique with Endotine Ribbon device that was proposed¹⁰ permitted a resultant vector of traction more lateral, making an angle of 45 degrees with a horizontal plane. This vector pulls obliquely in a lateral direction almost along the temporal crest. In this study, the suspension technique by using the Endotine Ribbon has given a good elevation of eyebrow tail and a more limited lifting in the body. The tines of the Endotine Ribbon allow multiple points of fixation and a wide distribution of strength in the anchorage between the deep and the superficial temporal fascia. This property is the major advantage of the ribbon over simple suture fixation. These results were quite stable after 6 months, but after 12 months, a certain degree of relapse occurred. This can be attributed to a resorption of the device and probably to a new sliding between superficial and deep temporal fascia, with a consequent drop of the

tissues. Creating a window on the deep temporal fascia by excision of a small segment will probably improve the long-term results, by enhancing adhesion areas, and performing a further stabilization of the tissues once the device will be reabsorbed. In fact, this biodegradable polymer is designed to absorb within the human body via hydrolysis after 1 year.

The technique using a permanent Mersilene mesh showed a good lifting of the tail, initially similar to that obtained with the ribbon, and a more pronounced elevation of the central brow body. In fact, by suturing the caudal portion of the mesh behind the orbicularis muscle, the medial end of this device can be pushed near the eyebrow body. Both these brow portions remain more lifted over time (after 1 year). The reason could be that the mesh is a permanent device and thus the adhesion area on the mesh between superficial and deep temporal fascia does not change over time.

In fact, as described in patients who underwent surgery a second time, the mesh suspender becomes a kind of artificial suspensory aponeurosis being integrated by the surrounding tissues.⁸ The mesh acts as a permanent scaffold which supports significant fibrovascular growth. This permanent tissue fixation gives excellent function with low recurrence rates and minimizes the extrusion risk.¹⁶

With the mesh device, it is possible to elevate the brow and at the same time to reshape the entire arch. Moreover, during surgery, it is possible to check the brow's lift and evaluate the symmetry. If an unsatisfactory result is obtained, the mesh can be detached from the surrounding tissues and readjusted until the desired lifting and contour are achieved. In fact, the brow shape has a greater influence than the absolute brow position on a perceived mood. Opinions of patients and surgeons have changed quite significantly over time.^{17,18} It seems that the preference for a specific eyebrow shape depends on the observer's age¹⁹ and sometimes fashion trends can modify the requirements of patients and the aim of the surgeons, so it is important to manage the different eyebrow segments correctly.²⁰ The technique

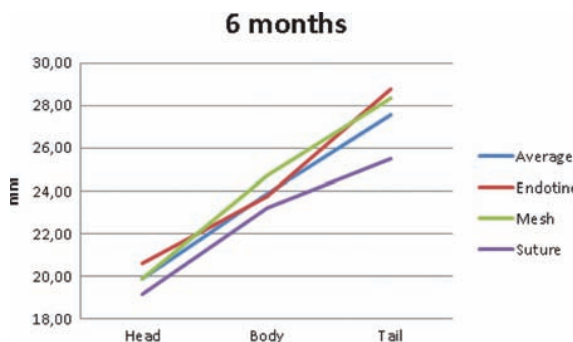


FIGURE 7. Brow position at 6 months of follow-up: the "suture" group begins to evidence a certain relapse overall in the lateral brow portion.

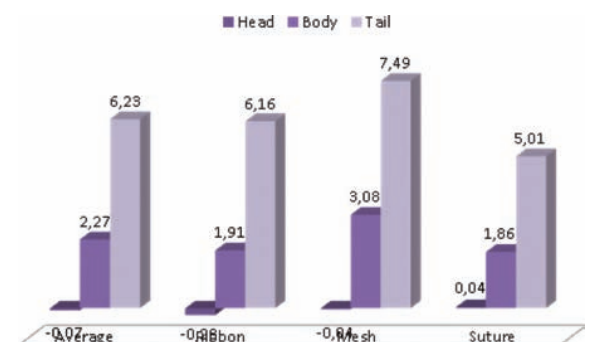


FIGURE 9. Comparison among the different techniques in terms of absolute values.



FIGURE 10. Pre- and postoperative photographs (A and B, respectively) of a patient treated with the Endotine Ribbon technique.

with the suspension suture instead seems to be both temporally and spatially limited. In fact, it results in a good elevation of the tail at the beginning, but this result is limited in the brow body. Moreover, after 6 months, a certain degree of relapse is visible in the medial and lateral region and the brow drop is further increased after 1 year, giving rise to a relatively poor long-term result. According to Mutaf,⁸ the gravity and the facial mimics that pull downward create a remarkable linear stress when exerted on each suspension thread, whereas the mesh technique provides suspension evenly along the entire lateral eyebrow because it is lifted as a single unit with a 3-cm-wide suspender. This allows the surgeon to create a pleasant eyebrow curve easily, with no risk of dimple formation and asymmetry. Moreover, it is an easy-to-perform procedure because no time is wasted with suture adjustment maneuvers, which may often be a burdensome part of brow lift surgery.

In the presented case series, the patients treated with the sutures had the lowest brow position before surgery, and this was an unwanted feature; consequently, to better evaluate the results, the differences between brow final position 1 year after surgery and brow initial position were measured (Fig. 9). The permanent mesh gave rise to an average lifting of the tail of 7.49 mm; the ribbon, 6.16 mm, and the suture, 5.01 mm. The brow body evidenced a major increase in elevation with the mesh being 3.08 mm in absolute value and 41.12% of the tail lift. With the ribbon, the brow body lifted 31% of the tail and with the suture, 37%. These results must be evaluated by considering the influence of upper blepharoplasty that was performed, and that could have been affected the measurements; in every case, the skin resection was very conservative and almost unable to change the results.

CONCLUSIONS

It is important for the surgeon to manage the different surgical options and to assess the final result in terms of effectiveness and durability in the lifting of a precise portion of the eyebrow. The number of cases used in this study has been limited and further measurements could improve our knowledge, but the result of this research demonstrates that all these techniques are useful when brow lift is aimed to obtain an elevation of the lateral brow, which is the most indicated procedure in young people. The temporal brow lift is simple and relatively quick and safe to perform, particularly when lifting the medial part of the brow is not expected to improve the appearance as it is the norm for the older patients.



FIGURE 11. Brow lift with Mersilene mesh fixation before (A) and 1 year (B) after surgery.

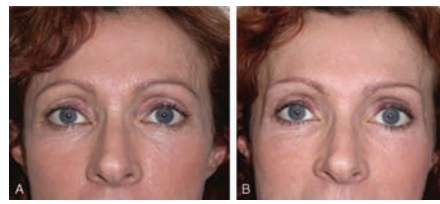


FIGURE 12. Suture fixation in temporal brow lift surgery before (A) and after 1 year (B) of follow-up.

Moreover, the mesh technique showed a better performance not only for the brow tail but also for the central portion, giving rise to a finer modulation of the brow shape that is the most appreciable feature for every patient.

REFERENCES

- Berisha F, Johnston A, McOwan PW. Identifying regions that carry the best information about global facial configurations. *J Vis* 2010;10:1–8
- Schmidt KL, Bhattacharya S, Denlinger R. Comparison of deliberate and spontaneous facial movement in smiles and eyebrow raises. *J Nonverbal Behav* 2009;33:35–45
- Siqueira M, Joaquim A, Schellini SA, et al. Eyelid alterations after the age of 50 years. *Arq Bras Ophthalmol* 2005;68:285–290
- Knize DM. An anatomically based study of the mechanism of eyebrow ptosis. *Plast Reconstr Surg* 1996;97:1321–1333
- Knize DM. Anatomic concepts for brow lift procedures. *Plast Reconstr Surg* 2009;124:2118–2126
- Paul MD. The evolution of the brow lift in aesthetic plastic surgery. *Plast Reconstr Surg* 2001;108:1409–1424
- Georgescu D, Anderson RL, McCann JD. Brow ptosis correction: a comparison of five techniques. *Facial Plast Surg* 2010;26:186–192
- Mutaf M. Mesh lift: a new procedure for long-lasting results in brow lift surgery. *Plast Reconstr Surg* 2005;116:1490–1499
- Lee JW, Cho BC, Lee KY. Direct brow lift combined with suspension of the orbicularis oculi muscle. *Arch Plast Surg* 2013;40:603–609
- Pascali M, Gualdi A, Bottini D, et al. An original application of the Endotine ribbon device for brow lift. *Plast Reconstr Surg* 2009;124:1652–1661
- Tuccillo F, Jacovella P, Zimman O, et al. An alternative approach to brow lift fixation: temporoparietalis fascia, galeal, and periosteal imbrication. *Plast Reconstr Surg* 2007;119:692–702
- Stevens WG, Apfelberg DB, Stoker DA, et al. The Endotine: a new biodegradable fixation device for endoscopic forehead lifts. *Aesthet Surg J* 2003;23:103–107
- Berkowitz RL, Jacobs DI, Gorman PJ. Brow fixation with the Endotine forehead device in endoscopic brow lift. *Plast Reconstr Surg* 2005;116:1761–1770
- Holzappel AM, Devinder S, Mangat MD. Endoscopic forehead-lift using a bioabsorbable fixation device. *Arch Facial Plast Surg* 2005;6:389–393
- Chowdhury S, Malhotra R, Smith R, et al. Patient and surgeon experience with the endotine forehead device for brow and forehead lift. *Ophthalm Plast Reconstr Surg* 2007;23:358–362
- Hintschich CR, Zürcher M, Collin JR. Mersilene mesh brow suspension: efficiency and complications. *Br J Ophthalmol* 1995;79:358–361
- Booth AJ, Murray A, Tyers AG. The direct brow lift: efficacy, complications, and patient satisfaction. *Br J Ophthalmol* 2004;88:688–691
- Wong BJ, Karimi K, Devic Z, et al. Evolving attractive faces using morphing technology and a genetic algorithm: a new approach to determining ideal facial aesthetics. *Laryngoscope* 2008;118:962–974
- Feser DK, Gründl M, Eisenmann-Klein M, et al. Attractiveness of eyebrow position and shape in females depends on the age of the beholder. *Aesthetic Plast Surg* 2007;31:154–160
- Knoll BI, Attkiss KJ, Persing IA. The influence of forehead, brow, and periorbital aesthetics on perceived expression in the youthful face. *Plast Reconstr Surg* 2008;121:1793–1802