Cosmetic

Minimal Access Cranial Suspension Lift: A Modified S-Lift

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There is a strong trend at hand toward less dramatic facial rejuvenation surgery. Most of the authors’ patients want a cosmetic improvement but not at the cost of prolonged disfigurement or a high risk of complications. In 1999, a very simple but effective rhytidectomy technique, termed an S-lift, was described in the literature and was adopted by the authors. Its basic principle is the suspension of sagging facial features by a strong, permanent purse-string suture. The procedure is performed with the patient under local anesthesia. Significant modifications were applied to the incision, to the purse-string suture anchoring site, and to the direction and shape of the skin excision. The authors named the modified procedure the minimal access cranial suspension lift to specifically describe the concept of the technique. Through an inverted L-shaped preauricular incision with extension below the sideburn, a limited skin undermining is performed. Two strong, permanent purse-string sutures are woven into the superficial musculoaponeurotic system tissues in a vertical U and an oblique O shape, initiating from a strong anchorage in the deep temporal fascia at the level of the helical crus. Tying these sutures produces a very powerful vertical correction of descended facial features that acts mainly on the jowls and the upper neck. The procedure can be extended by continuing the dissection over the malar fat pad, placing a third vertical purse-string suture with strong action on the nasolabial groove, and vertically repositioning the midfacial volumes. During 20 months, pleasing results and a very low complication rate were obtained in 88 consecutive patients with a mean age of 55 1/2 years. In this article, the authors provide a detailed description of the anesthetic and surgical technique, a demonstration of the results in different patient age categories, and a discussion comparing the minimal access cranial suspension lift with other types of facial rejuvenation procedures. (Plast. Reconstr. Surg. 109: 2074, 2002.)

Most patients consulting for facial rejuvenation have their own opinion about the desired result and the extent of the operation. This may be strongly different from the vision of the plastic surgeon, who may be inclined to propose a comprehensive facial rejuvenation treatment. Most European patients want to look younger without evidence of their having had a face lift. Some patients refuse to have the plastic surgeon operate on their eyebrows or eyelids. During consultation for facial rejuvenation, most patients demonstrate a maneuver that they have repeatedly performed in front of the mirror: they push the skin of the mandibular angle and the zygomatic region cranially (Fig. 1). To fulfill the wish of these patients, the S-lift, an operation that was originally proposed by Saylan,1 has been redesigned. The term S-lift is confusing and refers only to the S-shaped skin pre-excision, which belongs to the originally described technique and which was abandoned by us because it was not surgically sound. Therefore, we renamed the modified procedure the minimal access cranial suspension lift (MACS lift) to specifically describe the concept of the technique.

MATERIALS AND METHODS

The MACS lift is performed as an outpatient procedure with the patient under local anesthesia and minimal sedation. A total of 2.5 mg of midazolam is given intramuscularly before preparation and draping. This provides a comfortable relaxation, without diminished consciousness. Tumescent infiltration with local anesthesia is provided with a 22-gauge spinal needle by using a diluted solution of 0.3% lidocaine, 1:650,000 adrenalin, and 2 mEq of sodium bicarbonate2 (Table I). The same solution is used for any ancillary procedure, such as liposuction of the submental region, upper or lower blepharoplasty, lipofilling, or laser resur-
facing of the central portion of the face. When performing a MACS procedure separately, an average of 30 ml of this infiltration solution is used on each side of the face. At least 10 minutes is allowed for adequate blanching of the infiltrated skin. During this time, a closed-suction lipectomy of the submental area is performed in more than 95 percent of cases. This is done in the supraplatysmal plane with a 2.5-mm spatula-tip cannula. Suction of the subplatysmal region or the jowls is never performed. There are two types of MACS lifts: the simple and the extended.

Simple MACS Lift

An inverted L-shaped preauricular incision starts at the most caudal end of the earlobe, is directed upward, following the earlobe crease, crosses the incisura intertragica perpendicularly, makes a little indentation to go on the tragal rim, follows the anterior border of the helical crus, further follows the hairline in the non–hair-bearing recess in front of the ear, and then turns anteriorly along the inferior limit of the sideburn. A limited skin flap is undermined in an oval area extending from 1 cm above the zygomatic arch to the mandibular angle caudally and about 5 cm in the anterior direction (Fig. 2, left). Undermining of the skin flap is performed with face-lift scissors in the spreading mode. Because of the tumescent infiltration, a natural subcutaneous plane can be found by simply spreading the scissors in a plane parallel to the skin. One centimeter in front of the anterior margin of the helical crus and 1 cm cranially to the zygomatic arch, an additional injection of local anesthesia is given down to the temporal bone. With pointed iris scissors in a spreading mode, the deep temporal fascia is exposed over about 0.5 cm², taking care not to injure the superficial temporal vessels.

A first purse-string suture is made with 2.0 Prolene monofilament on a big needle (V7

| TABLE I |
| Anesthetic Solution for Tumescent Infiltration in Minimal Access Cranial Suspension Lift |

<table>
<thead>
<tr>
<th>Solution</th>
<th>Amount</th>
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<tbody>
<tr>
<td>0.9% sodium chloride</td>
<td>100 ml</td>
</tr>
<tr>
<td>2% lidocaine solution</td>
<td>20 ml</td>
</tr>
<tr>
<td>0.2 mg of adrenalin</td>
<td>0.2 mg</td>
</tr>
<tr>
<td>8.4% sodium bicarbonate</td>
<td>2 ml</td>
</tr>
<tr>
<td>(0.3% lidocaine, adrenalin 1:650,000)</td>
<td></td>
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Fig. 1, (Left) Typical maneuver of patients between 40 and 50 years old in response to being asked what they expect from a lifting procedure: They push the region of the mandibular angle cranially to correct the sagging in the lower third of the face, (Right) Typical maneuver of patients older than 50 years in reply to the same question: They push the region of the mandibular angle and the zygoma cranially to correct the sagging of the lower and middle third of the face.
needle, Ethicon, Inc., Somerville, N.J.). The first bite is taken deep down to the temporal bone (to be sure that the deep temporal fascia is included) in a craniocaudal direction (Fig. 2, right). The needle usually exits at the pretragal area. The purse-string suture is continued in a narrow U-shape, first in a craniocaudal direction, descending in front of the ear from the first bite down to the mandibular angle, making a U-turn, and returning 1 cm anteriorly in a parallel cranial direction to the starting point. A firm amount of parotid fascia in the cranial part and of platysma in the caudal part is taken with every bite of the needle. The purse-string suture is then tied under maximum tension, exerting vertical traction on the platysma, which causes strong elevation of the whole anterior neck region. Seven knots are tied on this monofilament suture. The knot is buried in the soft tissue to prevent it from being visible or palpable through the skin.

A second purse-string suture is started at the same point and is directed in an angle of about 30 degrees anterior to the original vertical purse string in a more open, oval shape to correct the jowling and the marionette grooves. The suture is carried to the edge of the undermined area and then taken back to the starting point (Fig. 2, right). After tying this suture under maximum tension, a very effective elevation of the jowls is seen. At this moment, some dimpling will be seen at the limits of the undermined skin, which is corrected by freeing the retracted skin with scissors. The excess skin is redraped in a pure cranial direction, marked, and resected. The skin is sutured under strong vertical tension with five subcutaneous sutures of 4-0 Vicryl. There is no traction in the horizontal direction. The preauricular incision is sutured under minimal tension. The earlobe, which is pulled cranially by putting vertical tension on the skin flap, is simply set back without tension as a little transposition flap. This avoids the risk of creating an unnatural, pulled-down earlobe. Sometimes a small dog-ear will appear behind the earlobe. To avoid a scar behind the ear, it is not resected. The patient is informed preoperatively about the possibility of this small dog-ear and about its spontaneous disappearance within 2 months. A small Penrose drain is inserted in the lowest part of the incision at the earlobe, and a further closure of the skin is performed with 5-0 Vicryl subcutaneously and with 5-0 and 6-0 nylon continuous and interrupted skin sutures. Ice cooling is applied for 2 hours after the procedure, and a light compressive dressing is left on for 1 day. The patient can leave the office 2 hours after surgery. The dressing and Penrose drain are removed the next day, and the patient can shower and wash his or her face and hair from then on. During the first 24 hours after surgery, patients are allowed to take limited amounts of soft food together with oral antibiotics and pain medication (paracetamol). All patients are offered the opportunity of having daily facial lymphatic drainage massage during one week, starting on postoperative day 4. All sutures are removed at day 7.

Extended MACS Lift

To enhance the effect on the nasolabial groove and to lift the malar fat pad and the midface, the incision is extended along the anterior border of the temporal hairline (Fig. 3, left). The subcutaneous undermining is extended over the area of the malar fat pad and a third, narrow, U-shaped purse-string suture is placed between the anterior part of the deep temporal fascia and the malar fat pad (Fig. 3, right). By putting tension on this suture, an obvious flattening of the nasolabial groove and raising of the malar fat pad will result. This modification was designed in August of 2000.

A simple MACS lift is performed in approximately 1½ hours. An extended MACS lift takes 2 hours. Table II summarizes the modifications made to the originally described S-lift and the

![Fig. 2. (Left) Preoperative marking of the preauricular and infracapillary incision (solid line) for the minimal access cranial suspension lift. The dotted line indicates the extent of undermining, and the arrow indicates the vector of traction. (Right) Minimal access cranial suspension lift. Position of the vertical, narrow purse-string suture and the 30-degree oblique, wide purse-string suture on the nonundermined superficial musculoaponeurotic system, with anchoring to the deep temporal fascia. Sutures performed with 2-0 Prolene.](image)
RESULTS

Between December of 1999 and June of 2001, 88 MACS lifts were performed (81 women, seven men). The mean age was 55 1/2 years, ranging from 38 to 82 years (Figs. 4 through 9). The simple MACS lift was performed on 54 patients, and the extended MACS lift on 34 patients. All procedures were performed with the patient under local anesthesia, with minimal sedation, and in an office setting, except for four patients with a history of medical disorders (hypertension, thromboembolic history). The operations for these four patients occurred with the patient under local anesthesia, with sedation given by an anesthesiologist, and in a hospital setting. During the first 3 days, all patients experienced marked but bearable pain in the temporal region and a limitation of mouth opening. This was probably caused by the traction on the temporal fascia by the purse-string sutures. All patients showed a temporary swelling of the cranial portion of the sternocleidomastoid region that disappeared within 2 weeks. Most of the patients were able to return to their normal activities 1 week after surgery with the help of some camouflaging makeup. On postoperative day 14, all patients were able to go out without any makeup. Patients in whom an extended MACS lift was performed showed a few more days of swelling in the malar area. There were no demands for surgical removal of dog-ears behind the earlobe because they all disappeared within 2 months after surgery. Patient satisfaction was very high. In all patients, the desired correction of the aging facial features was obtained and remained stable for the extent of our follow-up. From a surgical point of view, the short operating time, pleasing results, quick recovery period, and absolute absence of major complications were considered very important advantages of this procedure. Two hematomas had to be evacuated: one at the end of the surgery and one 8 hours postoperatively, in a very active man who went to work immediately after surgery. The resulting scars were inconspicuous. The effect of the surgery can be considered stable, as demonstrated in our patient with the longest follow-up of 18 months (Fig. 9).

DISCUSSION

Facial aging is caused by a multitude of factors: the years of gravitational pull on the soft tissues between the skin and the facial skeleton, loss of elasticity of the skin caused by intrinsic and extrinsic factors, possible facial deflation caused by fat atrophy,5,6 or even bony resorption.7,8 These different possibilities explain the multitude of therapeutic approaches.9–17 One can rejuvenate the skin by using resurfacing techniques, lifting the sagged soft tissues, augmenting deflated areas with autologous or other materials, or combining different procedures. The MACS lift, as described above, is fundamentally a pure antigravitational lifting procedure that will suspend the sagging soft tissues of the face and neck, together with the adhering skin, in a vertical direction into the place where they previously belonged. When counseling candidates for facial rejuvenation, most of them make a maneuver with the fingertips on the mandibular angle or the malar region, pushing the skin and the facial soft tissues in an upward direction (Fig. 1). Therefore, any technique that works in a caudocranial vertical direction will have a visual anti-aging effect, whether it is a lateral removal of the superficial musculoaponeurotic system (SMAS),12 a cranial suspension with purse-string sutures,1 a subperiosteal open14 or endoscopic approach,9 or a deep-plane face-lift technique.16 In contrast to the most frequently proposed classic face lifts,10 which all have a
strong lateral vector of displacing soft tissues, the MACS lift is a pure vertical-vector face lift. In recent years, the tendency has been toward less invasive techniques in facial rejuvenation surgery. Baker showed an evolution in his face-lift techniques from extended classic dissections toward minimal incision techniques and from a lateral pull to more cranially directed displacement of the soft tissues. Also, Finger proposed minimal skin and SMAS dissections, in combination with subperiosteal midface lifts, and demonstrated stable and natural results with minimal postoperative morbidity.

The ultimate determinant of a successful rhytidectomy is a happy patient. Listening to our patients’ desires is essential to be able to fulfill them. Therefore, we believe the ideal facial rejuvenation procedure is an intervention with a visible but natural change, with minimal risks, minimal morbidity, and minimal social discomfort. Offering the MACS lift as a safe outpatient office procedure is welcomed with great enthusiasm because of the strong resistance to hospital admission of most cosmetic surgery candidates and their reluctance to pay hospital expenses.

Subperiosteal procedures can produce dramatic changes with beautiful long-term results, but patients sometimes have swelling that remains for 6 months. Also, by raising the periosteum, tissue is moved to a position where it has never been. Indeed, the periosteum is the only anatomic structure that stays fixed to the bone over an entire lifetime. With the MACS procedure, the sagging soft tissues are brought back to their original position with a simple suturing technique placed directly in the ptotic tissue.

With Baker, we share the disappointment about the morbidity and the poor long-term results of anterior corset platysmaplasty. By pulling strongly on the lateral part of the platysma at the mandibular angle in a cranial direction, platysmal bands will disappear in most cases. We limited our indications for anterior platysmaplasty to the few cases in which the platysmal bands did not disappear with upward traction on the platysma in the region of the mandibular angle. The combination of moderate-to-aggressive fine-needle liposuction of the submental region with a strong cranial suspension of the platysma and SMAS, as done in the MACS procedure, offers a simple and valuable alternative.

In a classic face lift, the retroauricular and occipital incision is used to create the posterior part of the skin flap. The traction on this flap in the oblique upward direction basically only redrapes skin and has little or no rejuvenating effect. Most of the skin resection in a classic face-lift design is done in the occipital region, producing the classic problems of hairline displacement or noticeable pretrichial scars, a problem that was never encountered in our patient group.

The horizontal limb of the MACS-lift incision enables us to excise a large amount of facial skin in a vertical direction without elevation of the hairline. The extension of this

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**TABLE II**

Comparison of the Original S-Lift Technique with the Described Simple and Extended Minimal Access Cranial Suspension (MACS) Lifts

<table>
<thead>
<tr>
<th>S-Lift</th>
<th>Simple MACS Lift</th>
<th>Extended MACS Lift</th>
</tr>
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<tbody>
<tr>
<td>Pre-excision of skin</td>
<td>No pre-excision of skin</td>
<td>No pre-excision of skin</td>
</tr>
<tr>
<td>S-shaped skin incision, crossing the non-hair-bearing skin at the helical root</td>
<td>Inverted L-shaped skin incision following lower border of sideburn</td>
<td>Inverted L-shaped skin incision following lower border of sideburn and extending along anterior temporal hairline</td>
</tr>
<tr>
<td>Oval-shaped skin undermining</td>
<td>Oval-shaped skin undermining</td>
<td>Oval-shaped skin undermining with extension over malar fat pad</td>
</tr>
<tr>
<td>Vertical U-shaped and oblique O-shaped purse-string sutures on SMAS</td>
<td>Vertical U-shaped and oblique O-shaped purse-string sutures on SMAS</td>
<td>Vertical U-shaped and oblique O-shaped purse-string sutures on SMAS and oblique U-shaped purse-string suture between malar fat pad and deep temporal fascia</td>
</tr>
<tr>
<td>Purse-string suture fixation to periosteum of the zygomatic arch</td>
<td>Purse-string suture fixation to deep temporal fascia</td>
<td>Customized skin excision after redraping in vertical direction</td>
</tr>
<tr>
<td>Skin redraping at 45-degree angle</td>
<td>Customized skin excision after redraping in vertical direction</td>
<td>No skin incision behind earlobe</td>
</tr>
<tr>
<td>Skin redraping behind earlobe</td>
<td>No skin incision behind earlobe</td>
<td>Effect on anterior neck and jowls</td>
</tr>
<tr>
<td>Effect on anterior neck and jowls</td>
<td>Effect on anterior neck and jowls</td>
<td>Effect on anterior neck, jowls, midface, and nasolabial fold</td>
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</table>

SMAS, superficial musculoaponeurotic system.
incision in a pretrichial cephalic direction makes action on the midface possible in the extended MACS lift. After meticulous closure of this incision, very inconspicuous scars can be obtained.

The sagging of the midface can be treated
through different approaches. A lateral approach was suggested by Hamra,\textsuperscript{16,25} Stuzin et al.,\textsuperscript{26} Owsley and Fiala,\textsuperscript{4} and Connell and Semlacher.\textsuperscript{27} Hester et al.\textsuperscript{28} described a more vertical approach through a lower eyelid incision. A subperiosteal approach, introduced by Tessier,\textsuperscript{14} was recently modified by Little.\textsuperscript{15} Byrd and Andochick\textsuperscript{29} used the endoscope through the temporal approach, and Yaremchuk\textsuperscript{30} recently proposed a combination of different approaches. Disappointed by the high complication rate of lower eyelid approaches\textsuperscript{28}
and the long recovery period of subperiosteal midface elevation, we decided to use the lateral approach. An extra U-shaped purse-string suture is placed between the anterior part of the deep temporal fascia and the malar fat pad to lift the whole midface with an oblique to an almost vertical vector.

The debate between limited and extended...
undermining of the facial skin is ongoing. Some authors are convinced that extensive undermining and radical skin resection leads to better and more long-lasting results.\textsuperscript{31} Beautiful anatomic studies about the retaining ligaments of the face have been published, together with the statement that these ligaments are to be divided to be able to resect more

![Fig. 7. (Above, left and right) Three-quarter and profile views of a 60-year-old man with marked jowls, marionette grooves, laxity of the anterior neck skin with marked platysmal bands, and general sagging of the midface. (Below, left and right) Results 11 months after extended minimal access cranial suspension lift and discrete upper blepharoplasty. Note adequate correction of the jowls, marionette grooves, and anterior neck skin laxity without platysmaplasty. There is a nice volumetric rejuvenation of the midface area. No lower eyelid surgery was performed.](image-url)
But why should we transect the only supporting structures of the skin? Concerning the stability of the results, we realize that 18 months of follow-up is short, but over that period the results have been as good and as stable as in classic SMAS-lift techniques. Because the original S-lift procedure as described by Saylan\textsuperscript{1} has some illogical steps against elementary plastic surgery principles, a lot of skepticism was raised about this intervention. Some surgeons compare this procedure with a technique described in 1919 by Passot,\textsuperscript{35}
merely consisting of an S-shaped excision of preauricular skin without any undermining, but the purse-string sutures do much more than that.

The original Saylan S-lift design was modified as follows. The S-shaped pre-excision of skin was abandoned. First, one can never tell how much skin must be removed at the end of the operation; second, after pre-excision of skin, the surgeon is forced to manipulate and pull during the surgery on skin that will be sutured at the end. Purse-string sutures are

Fig. 9. Longest follow-up case (18 months). (Above, left and right) Preoperative frontal and profile views. (Below, left and right) Postoperative frontal and profile view. There is a stable result in the correction of the jowls and cervicomental angle after a simple minimal access cranial suspension lift procedure, upper blepharoplasty, and lower orbicularis suspension blepharoplasty.
anchored to the rigid deep temporal fascia rather than to the fragile periosteum of the zygomatic arch. Skin redraping is performed in a vertical direction instead of an oblique direction at a 45-degree angle (Table II).

The advantages of a MACS lift compared with classical lifting techniques are a quick procedure, local anesthesia, no hospital admission, a short recovery period, and an inconspicuous, short scar without raising of the temporal or occipital hairline. Perhaps most importantly, it is a safe procedure. Facial nerve injury and skin slough are unlikely to occur, and hematoma and postoperative numbness are significantly reduced. Also, the combination of centrofacial laser resurfacing and a MACS lift can be performed with great safety. Finally, the results seem to be very pleasing and natural, eliminating the classic face-lift stigmata, thanks to the limited incision and emphasis on vertical tissue displacement.

Conclusions

The original S-lift technique as described by Saylan has been modified by the authors into a procedure that is called the MACS lift. The procedure is performed under local anesthesia, with minimal sedation, in an office-based practice. A simple MACS lift takes no longer than 1½ hours and mainly affects the lower third of the face. The extended MACS lift also affects the middle third of the face and can be performed in 2 hours. The core principle of the MACS procedure is putting strong, non-resorbable purse-string sutures on nonundermined SMAS and anchoring it to a fixed and rigid temporal fascia. This produces effective and stable elevation and traction on the SMAS that is transmitted to other regions in the face, such as the jowls, the malar fat pad, or the nasolabial grooves. Skin resection is principally done in the temporal area after vertical traction and redraping. Both procedures produce highly satisfactory results for the surgeon and for the patient. The importance of this new technique is that it is essentially a vertical-vector face lift that works principally in an antigravitational direction.

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