International Journal of Multiphysics
Volume 18, No. 3, 2024
ISSN: 1750-9548

An Overview on Superficial Musculo-Aponeurotic System Technique in Face Lift

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Abstract:

The superficial musculoaponeurotic system, or SMAS, is often described as an organized fibrous network composed of the platysma muscle, parotid fascia, and fibromuscular layer covering the cheek. This system divides the face's deep and superficial adipose tissue and has region-specific morphology. Anatomically, the SMAS lies inferior to the zygomatic arch and superior to the platysma's muscular belly. The fibromuscular layer of the SMAS integrates with the superficial temporal fascia and frontalis muscle superiorly and platysma inferiorly. The SMAS may even be described as a fibrous degeneration of the platysma itself. In reality, a precise anatomical definition of the SMAS is unclear and has been thoroughly debated since Mitz and Peyronie first described this fibromuscular network in 1976. The SMAS is a key structure involved in facial aging. Understanding the anatomy and dynamics of the SMAS is critical for healthcare providers specializing in facial rejuvenation procedures.

Keywords: Superficial Musculo-Aponeurotic system, Face, Aging.

Introduction:

The facelift has significantly evolved over the past several decades. What was once considered a skin only operation is now a sophisticated, elegant procedure that requires meticulous preoperative analysis, understanding of underlying anatomically based aging changes, and extreme attention to detail. According to the American Society of Plastic Surgeons, 125,697 facelifts were performed in 2017. It is not surprising that given these advances that facial rejuvenation surgery is still a very common procedure with a high degree of patient satisfaction despite the increase in nonsurgical facial aging treatments **(1)**.

With an improved understanding of facial anatomy including the facial retaining ligaments and intervening superficial and deep fat compartments, the modern facelift requires an anatomically targeted approach. Furthermore, the modern facelift surgeon must achieve consistently excellent results with reasonably little downtime while being aware of methods to improve the safety of this popular elective procedure. Hematoma is the most common complication after rhytidectomy with an incidence between 0.9% and 9%, with a higher incidence in males. Other potential complications include seroma, nerve injury, skin flap necrosis, siaolocele as a consequence of submandibular gland debulking, and skin flap rhytid and hairline distortion. This review aims to discuss safe, consistent, and reproducible methods to achieve success with facelift **(2)**.

ANATOMY:

The superficial musculoaponeurotic system (SMAS) is the investing fascia of the facial mimetic muscles and is continuous with the platysma inferiorly and galea superiorly. Laterally, the SMAS is firmly adherent to the parotid–masseteric fascia where it is known as the immobile SMAS. The facial retaining ligaments transmit through the SMAS to the overlying skin, either originating from the periosteum (zygomatic and mandibular retaining ligaments) or from underlying muscle fascia (masseteric and cervical retaining ligaments). These retaining ligaments also serve as barriers between the superficial and deep facial fat compartments with neurovascular structures, or “facial danger zones,” located between these retaining ligaments **(3).**

Indications for face lift :

- Skin and soft tissue laxity of the lower face
- Jowling
- Facial asymmetry due to chronic flaccid facial paralysis
- Plastysmal banding, if concurrent neck lift or platysmaplasty is planned
- Reasonable expectations for outcomes **(4)**

Contraindications:

- Inability to set reasonable outcome expectations
- Psychiatric dysfunction
- Significant ptosis of the malar fat fads with deep nasolabial folds
- Significant adiposis of the facial soft tissues
- Weight instability
- Active smoking
- Collagen vascular diseases or other wound-healing anomalies
- Uncontrolled diabetes
- Uncontrolled hypothyroidism
- Uncontrolled hypertension
- Bleeding diathesis or inability to discontinue anticoagulants perioperatively
- Malnutrition
- Poor cardiopulmonary reserve**(5)**

AGING CHANGES:

Facial aging is a complex and multi-dimensional process involving a combination of intrinsic and extrinsic factors. The aging process affects both the hard and soft tissues of the face, resulting in a wide range of structural and morphological changes. The skeletal, dental, and cartilaginous structures undergo alterations, leading to loss of volume and support. Fat loss and atrophy, along with the attenuation of the fibro-oseo-cutaneous ligamentous structure, further contribute to facial changes.

Muscular and somatosensory systems are also affected by ageing, leading to changes in facial expressions and sensory perception. These changes can manifest as hollowing in specific regions such as the temporal, buccal, and periorbital areas, deepening of nasolabial folds, concavity of the cheeks, and loss of structural support in the perioral region. The effects of facial muscular contractions can be etched on the skin, resulting in the appearance of facial hypertrophy, ptosis, or skeletonisation.

These age-related morphological changes in the face can have psychological impacts on an individual, as they may project negative emotions and affect personal and social interactions. It is important to understand the multifactorial nature of facial ageing to develop effective interventions and preventive strategies. By addressing factors such as obesity, smoking, sun exposure, and promoting healthy lifestyle choices, it is possible to mitigate the accelerated ageing process and enhance the overall well-being and quality of life for individuals as they age**(6)**.

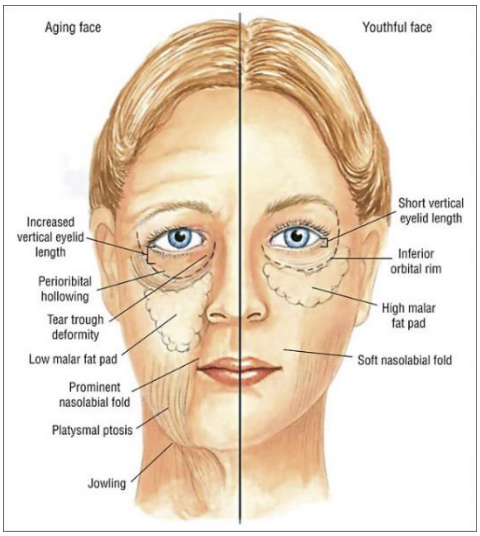

Figure (1): Youthful face vs aging face. Note how the increased laxity in the orbicularis retaining ligaments and the zygomaticocutaneous ligaments ultimately results in a descent of the lid-cheek junction and increased vertical length of the lower eyelid. Also, the malar fat pads descend, resulting in a loss in the cheek prominence, a tear trough eyelid deformity, and the appearance of prominent nasolabial folds.**(7)**.

Facial Analysis and Preoperative Planning:

On examination, facial horizontal fifths and vertical thirds are analyzed to determine overall facial balance, making note of any asymmetries. The relationship between facial length, midfacial width, and overall fullness is critical as this guides the customized surgical intervention which, depending on asymmetries in the individual patient, may vary on each side (Fig.4). The neck, décolletage, and skin elasticity and quality are evaluated. The patient is asked to provide photographs from youth to better assess areas of volume loss and changes that have occurred with time. Standardized facial photographs are obtained and essential for preoperative planning, patient counseling, and medicolegal purposes. It is important to note if the patient would benefit from ancillary procedures including brow lift, blepharoplasty, rhinoplasty, lip lift, genioplasty, and skin resurfacing procedures to improve facial aesthetic harmony **(8)**.

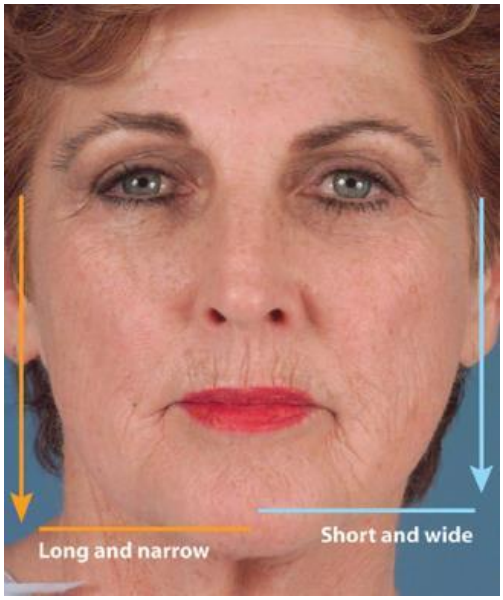

Figure (2): Preoperative analysis for the individualized component facelift. Anteroposterior view is used to determine midface width, height, and overall facial shape and soft-tissue distribution **(9)**.

A thorough patient history and physical examination are performed. A full list of medications and supplements must be reviewed to ensure no consumption of blood thinners. Any patient over 50 requires an electrocardiogram (EKG) in addition to full laboratory testing which includes blood counts, coagulation profile, and even electrolytes as it has been shown certain medications can cause potentially serious electrolyte disturbances perioperatively. Particular attention is paid to a history of hypertension and nicotine product use. If present, hypertension must be medically optimized and necessary medical clearances are obtained before surgery. The patient must cease nicotine product use for a minimum of 3 months before surgery to decrease the risk of skin flap necrosis. In smokers, urine nicotine metabolites are tested 1 month before surgery to confirm abstinence. Furthermore, the history of nonsurgical treatments including neuromodulators, fillers, and energy-based devices is noted as the authors have observed increased scarring in these patients during dissection **(10)**.

Incision Planning:

- **Temporal Incision:**

The distance between the lateral orbital rim and the anterior temporal hairline is assessed (Fig. 5). Skin redundancy and the anticipated amount of temporal skin excision is determined. If the estimated postoperative lateral orbital rim to anterior hairline distance is ≤5cm (ie minimal temporal skin resection), then the temporal portion of the incision can be concealed behind the hairline. If the anticipated distance is >5cm, then a prehairline incision is chosen to prevent postsurgical sideburn distortion **(11)**.

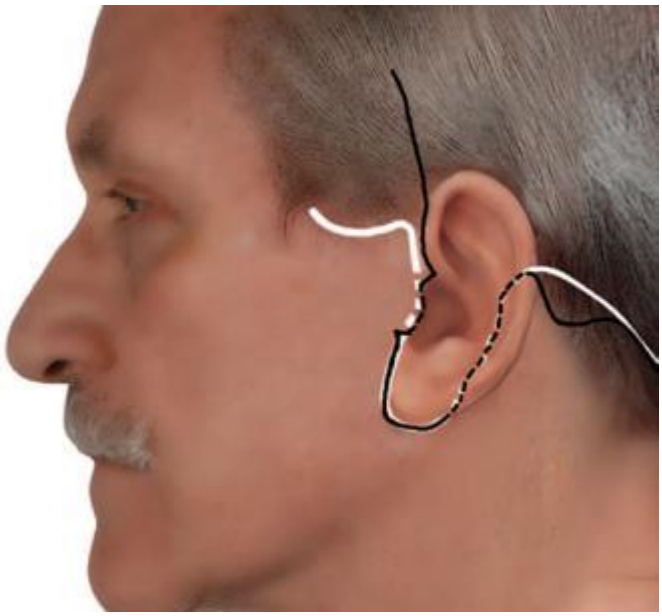

Figure (3): The rhytidectomy incision. White line, incision used by R.J.R.; black line, incision used by J.M.S**. (12)**.

- **Preauricular Incision**

The incision follows the ear–cheek junction curvature, except for the tragus, where a choice is made between a pre or intertragal incision. A pretragal incision may be appropriate if there is a prominent preauricular crease, a tall vertical tragus, or prominent lateral cheek hair follicles. Otherwise, the majority of patients are best served by an intertragal incision to prevent postsurgical skin color and texture mismatch of the tragus and lateral cheek. Along the ear lobule, the incision is made 1 mm caudal to the cheek–lobule junction to prevent distortion of the interface between these anatomic units **(13)**.

- **Retroarticular Incision:**

The incision continues into the retroauricular sulcus and is carried cephalically up to the midear. The decision to either carry the incision posteriorly into the scalp or inferiorly along the occipital hairline at the junction of the thin and thick hair is based on the estimated skin resection. If >2 cm of retroauricular skin resection

is anticipated, then the incision is made along the occipital hairline to prevent a step off in the occipital hairline **(14)**.

- **Submental Incision:**

The decision to open the neck is determined preoperatively based on the presence of cervical skin laxity and is accessed via a 3–4 cm incision marked 1–2 cm posterior to the submental crease. Surgical maneuvers are tailored to the individual patient. Considerations include the amount and location of excess cervical adiposity, the presence of jowling, severity of dynamic and static platysmal banding, and the distance between the medial platysmal borders (< or >2 cm; Fig.4).

Other authors advocate a more aggressive lateral platysmaplasty while avoiding a submental incision. Because the success of a modern facelift is often judged by the quality of the neck contour correction, in the authors experience, there is a low threshold to open the neck as doing so allows the ability to tighten via midline platysmaplasty, sculpt subplatysmal contents, and reduce the incidence of recurrent platysmal bands **(15)**.

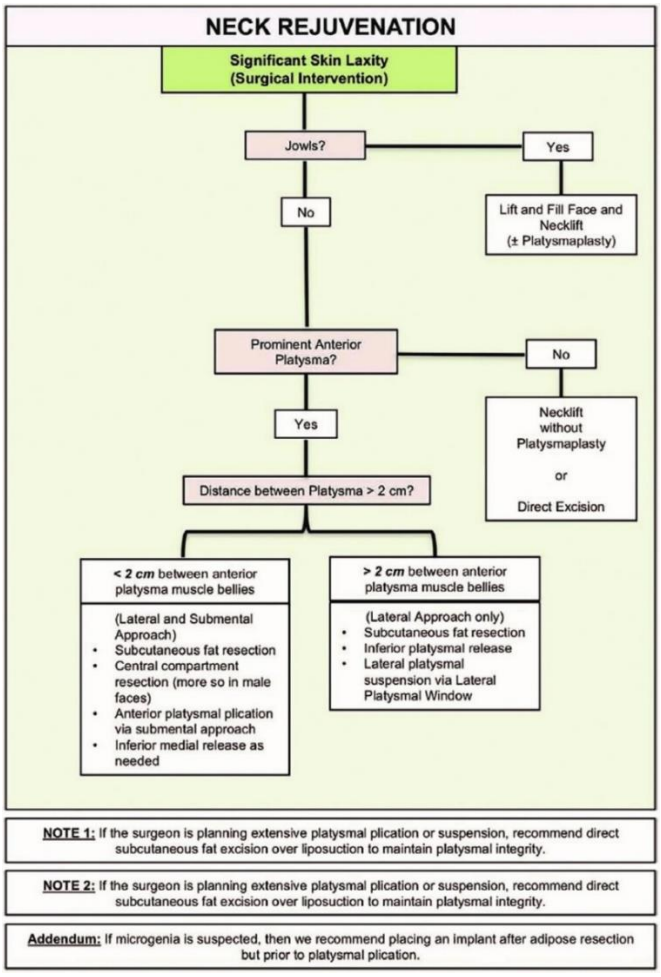

Figure (4): Neck rejuvenation algorithm for patients with moderate to severe skin laxity **(16)**.

Anesthesia and Perioperative Management:

Hypertension is a controllable risk factor for hematoma; therefore, strict multimodal blood pressure control is essential to minimize complications (Fig.5). Anxiety, pain, nausea, and vomiting are preemptively managed (Fig.6). All patients receive 2 mg of midazolam in the preoperative holding area. Males and patients with a history of hypertension undergo placement of a 0.2-mg clonidine transdermal patch in all other patients, a 0.1-mg clonidine patch is placed**(17)**.

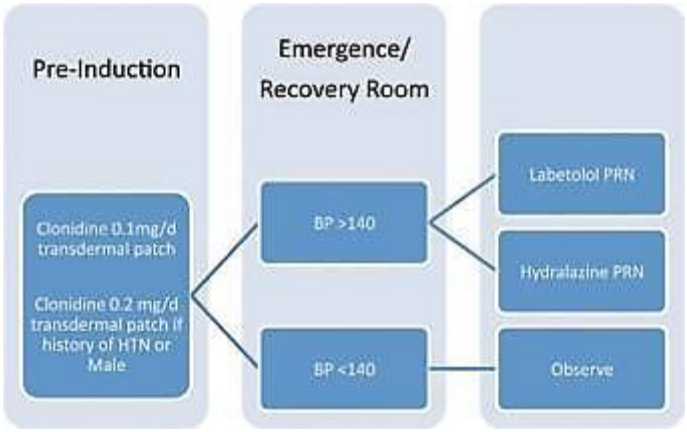

Figure (5): Hypertension management algorithm. HTN, hypertension; BP, blood pressure; PRN, as needed**.(18)**

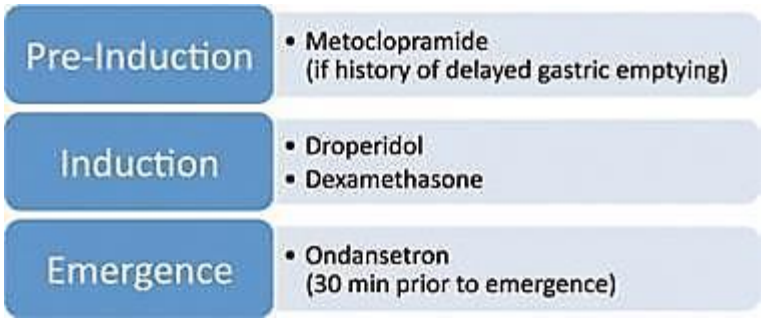

Figure (6): Nausea and vomiting prevention algorithm**.(19)**

General anesthesia is preferred. The endotracheal tube is placed midline and not secured, as it is monitored closely intraoperatively. Nitrous oxide is avoided due to an increased risk of postoperative nausea. Inhalational anesthetics are also avoided due to their propensity to cause vasodilation.

Dexamethasone (8 mg IV) is given after induction for both edema and nausea management, and 4 mg of IV ondansetron is given 30 minutes before emergence. Sequential compression devices are placed, and an indwelling urinary catheter is inserted. The face is widely prepped with ophthalmic betadine and 2 g IV cefazolin is given 30 minutes before incision. Some authors described that, venous blood is drawn upon induction to extract platelet-rich plasma. The platelet-rich plasma is then drawn into a 10-cm^3 dual-port sprayer syringe, with the second syringe containing an activating thrombin solution. Before skin closure, the activated platelet-rich/thrombin mixture is sprayed between the skin flap and underlying SMAS to help decrease ecchymosis and edema. The facelift incisions are then marked as previously described, based on preoperative assessment for optimal scar concealment and to minimize hairline distortion **(20)**.

Filling of The Facia Fat Compartments:

Fat grafting is performed at the beginning of the procedure to ensure meticulous injection and to minimize fat graft contamination. For details regarding the senior author's (R.J.R) technique, Nasolabial fold correction and restoration of youthful malar projection are by means of anatomically targeted fat grafting to the deep malar, deep nasolabial malar, and the high and middle superficial malar fat compartments (Fig.8). Typically, 1–3 ml of fat are injected per compartment. Additionally, perioral, earlobe, temple fat grafting is performed if indicated**.(21)**

Individualized Skin Flap Elevation:

A 22-guage spinal needle is used to inject 80–120 ml of infiltrate solution per side for the purpose of hemostasis and hydrodissection of the tissue planes. The infiltrate solution consists of 30 ml of 0.5% lidocaine and 1.5 ml of epinephrine (1:1,000) mixed with 300 ml of normal saline. The needle is inserted along the marked

facelift incisions to prevent additional flap trauma, with the solution infiltrated in the subcutaneous plane. The endpoint for infiltration is moderate and uniform skin turgor of the facial tissues. Ten minutes are allowed to elapse after infiltration before incision for optimal hemostatic effect. The marked facelift incisions are then completed with a 15 blade and the skin flaps are raised in the subcutaneous plane with facelift scissors. At least 3 mm of subcutaneous fat is left on the skin to maintain flap vascularity and to prevent contour irregularities **(22)**.

The extent of skin undermining is individualized to the shape and width of the patients face (Fig.9) and is ultimately determined intraoperatively once the SMAS maneuvers have been completed to confirm skin redraping without puckering. Limited skin flap elevation is performed in faces with mild skin laxity and wide malar width. In contrast, long faces with narrow bimaxillary width, jowling, and redundancy medial to the lateral canthus require extended skin undermining for more complete release of the mandibular septum, zygomatic, and masseteric retaining ligaments for proper skin redraping and medial SMAS advancement (Fig.10). Of note, medial perioral dissection is avoided as this results in postoperative deformities with facial animation due to dissociation of the skin with the underlying facial musculature**. (22)**

Figure (7): Area of subcutaneous skin flap undermining indicated in red **(23)**

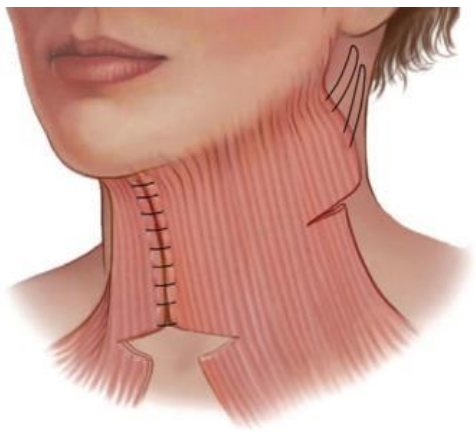

Figure (8): Inferomedial platysma is transected, platysmal midline stitches are placed, and a lateral platysmal window is performed**. (24)**

Open Treatment Of The Neck:

If the decision is made to open the neck, the submental incision is opened, and the facial/neck skin subcutaneous planes are connected. The senior author (R.J.R) has abandoned submental liposuction due to the

high incidence of contour irregularities. In the appropriately selected patient, the authors perform preplatysmal and central subplatysmal fat resection under direct vision. On a technical note, preplatysmal fat is resected from lateral to medial as it is easy to inadvertently enter the subplatysmal plane with a medial approach. The medial platysma borders are plicated with figure-of-eight 4-0 Mersilene from the inferior mandibular border down to the level of the thyroid cartilage, followed by a 2-cm inferior transverse platysma myotomy (Fig. 8)(**25)**.

The sequence of SMAS/lateral platysmaplasty and medial platysmaplasty is debated by some authors. Of note, proponents of SMAS maneuvers before medial platysmaplasty believe that medial platysmaplasty "locks down" the SMAS and limits lateral SMAS correction. However, the authors prefer to complete the medial platysmaplasty first, as they have not noticed subsequent restriction in lateral SMAS correction **(26)**.

Lateral platysmal window and SMAS maneuvers:

A 2-cm lateral subplatysmal "window" is made approximately 1 finger breadth below the mandibular angle and 1 cm anterior to the SCM border to avoid the great auricular nerve. The lateral platysma flap is secured to the mastoid fascia with 2 figure-of-eight spanning 3-0 Mersilene sutures. The decision of which SMAS technique to use is somewhat a topic of debate, including SMAS plication, SMASectomy, extended SMAS flap, high SMAS, and deep plane techniques. Despite the plethora of available techniques, the authors feel that the most reproducible, safe, and efficient techniques are SMAS-stacking for patients that need volume (i.e. long and narrow faces; Figs. 10, 11) or SMASectomy for patients that need tissue debulking **(27)**.

Figure (10): SMAS-stacking. SMAS incision and plication serve to stack tissue in the direction that the SMAS is lifted. The SMAS base remains while limited proximal and distal SMAS undermining allows the surgeon to create a 3-layered construct. This is beneficial in narrow faces that need more fullness in the malar region. This orientation of the SMAS-stacking will dictate where this augmentation is produced.**(27)**

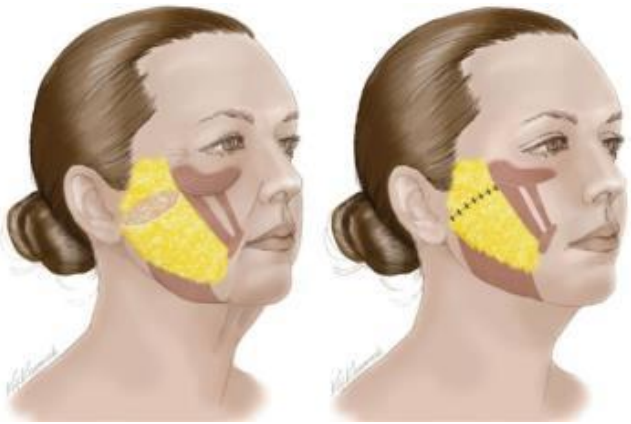

Figure (11): The oblique SMASectomy. SMAS movement is directed perpendicular to the nasolabial fold. This is beneficial for the narrower facial side **(28)**.

Skin Redraping and Closure:

The skin flaps are redraped along a posterosuperior vector—care is taken not to recruit cervical rhytids onto the face, as iatrogenic rhytid displacement is a telltale sign of a poorly executed facelift. As previously described, the final extent of skin flap undermining is completed to assure the absence of skin puckering. Gauze moistened with a 3% tranexamic acid solution is placed beneath the skin flaps and allowed to sit for 3–5 minutes to help reduce bleeding, bruising, and edema. The tranexamic acid-soaked gauze is removed, and the skin flaps are then conservatively trimmed and inset with minimal tension. Platelet-rich plasma/thrombin mixture is spayed between the skin and SMAS layers. **(29)**

A closed suction drain is placed in the neck via a stab incision in the occipital scalp. Sparing 3-0 Monocryl (Ethicon, Inc.) deep dermal sutures are used, followed by 5-0 Nylon (Ethicon, Inc.) interrupted skin sutures. Staples are used on the incisions in hair-bearing areas. It is important to highlighting that if a intertragal approach is performed, the tragal skin flap is defatted, and the surgeon must be cognizant of the need for additional skin to account for the pretragal concavity-failure to account for this will result in "tenting" of the skin flap in the pretragal area and tension on the tragus, leading to tragal eversion and exposure of the auditory canal. The submental incision is closed with a running external 5-0 Nylon suture (Ethicon, Inc.). Avoidance of tension on the skin closure is paramount to avoid postoperative scar widening and auricular distortion **(30)**.

Postoperative Management:

Patients are kept overnight with strict postoperative blood pressure, pain, and nausea management to prevent hematoma. The surgical dressings are changed the first postoperative day, and the neck drain is removed. The patient is allowed to return to regular activity 6 weeks after surgery and kept on a low-sodium diet for 1 month. Although the data are conflicting, a single 8 mg dose of intraoperative dexamethasone is given for both nausea prevention and to potentially decrease facial edema in the immediate postoperative period. However, available evidence at this time does not support the use of postoperative steroid use. An exception is in patients who undergo laser skin resurfacing, who are started on a methylprednisolone dose pack taper on postoperative day 1.**(31)**

Conclusions:

The modern facelift is a sophisticated operation that focuses on treating targeted areas of facial aging using an individualized and detailed approach to the SMAS, skin, and fat compartments. Maximizing patient safety and consistency is the key to this operation to deliver high patient satisfaction **(31)**.

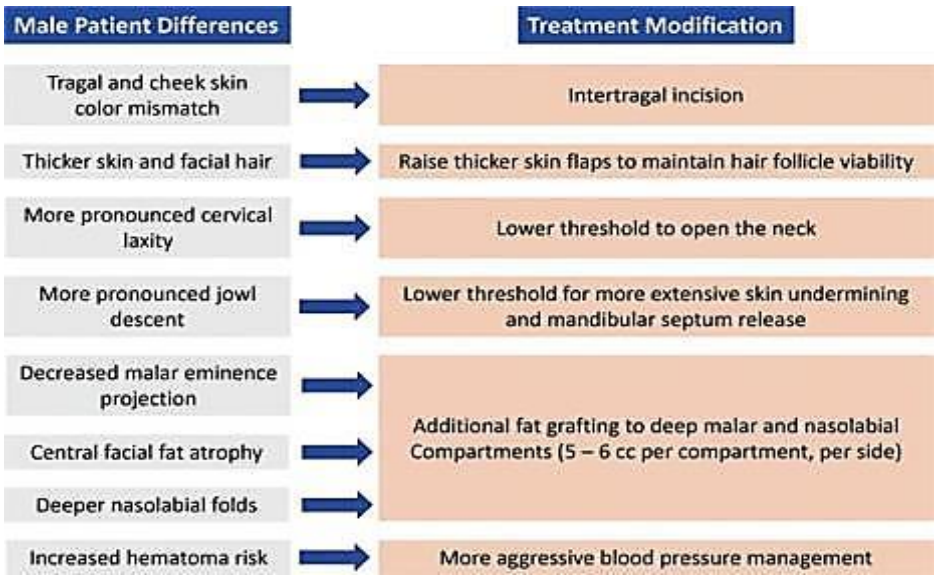

Figure (12): Secondary rhytidectomy patient analysis **(32)**.

Relation between facial nerve and dangerous areas of face:

- The facial nerve may be injured in its extra temporal course as a result of facial trauma and laceration, or iatrogenically during surgery involving the parotid or submandibular glands or the temporo mandibular joint or during face lift procedures.
- Knowledge of the topographical and surgical land marks that aid location of its branches is therefore essential if the nerve is to be preserved during surgery.
- The nerve exits the skull at the stylomastoid foramen and so is initially deep to the posterior margin of the external acoustic meatus.,the nerve trunk lies approximately 1 cm deep and inferior to the tragal point .It usually divides within the substance of the parotid gland into superior (temporofacial) & inferior (cervico facial) trunks which collectively give off five main peripheral branches that radiate out across the face.
- The course of **temporal branches** corresponds to a line extending anteriorly and superiorly from the attachment of the lobule (approx. 0.5 cm below the tragus) to a point 1.5 cm above the lateral aspect of the ipsilateral eyebrow. This branch is particularly vulnerable to damage as it runs over the zygomatic arch.and to a lesser extent in the lateral eye brow. It may be injured in facial rhytidectomy or with coronal or endoscopic brow lifting.
- The **buccal branches** have been described as running both above and below the parotid duct.
- The **marginal mandibular** nerve lies either along the body of the mandible (80%) or it may briefly enter the neck,where it lies within 1.2cm of the lower border of the body (20%). **(33)**
- **The greater auricular nerve** and external jugular vein, both of which are at risk of injury during face lifting, lie beneath the platysma and superficial to the sternocleidomastoid muscle, with the nerve running roughly 1 cm posterior to the vein . **(34)**
- Branches that enter neck curve upwards and re-enter face by crossing the lower border of the mandible at the anterior border of the masseter. As they do so, they also cross the facial artery and vein. Incisions to access to submandibular region of the neck therefore usually made at least1.5 cm (two finger breadth) below the lower border the mandible in order to avoid damage to the marginal mandibular branch. Injury results in ipsilateral paralysis of depressor angulioris and depressor labiiinferioris and produces a characteristic deformity.**(35)**

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