Neck Rejuvenation Revisited

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Purpose: Restoration of the aesthetic neck contour is an integral component of facial rejuvenation. Multiple deformities of the neck and chin complex can make treatment of the cervical region daunting. An algorithmic approach to neck rejuvenation based on individual anatomic and clinical analysis is prudent. The authors created a simplified anatomic approach to the most common cervical deformities encountered in the patient seeking facial rejuvenation.
Methods: Retrospective analysis of the senior author's (R.J.R.) technique evolution over the last 15 years was performed. The operative techniques used in neck rejuvenation were evaluated and the long-term postoperative results were reviewed.
Results: Recurrent patterns of cervical deformity are present in patients presenting for facial rejuvenation. These patterns can be classified into categories based on specific anatomic deformities.
Conclusions: Facial rejuvenation requires appropriate identification of deformity to effect the desired changes. Cervical deformities are classified into clinically useful categories based on careful preoperative analysis. A thorough understanding of the anatomic bases for the deformities allows the surgeon to choose the appropriate treatments to achieve consistent and reliable results. (*Plast. Reconstr. Surg.* 118: 1251, 2006.)

The aesthetic face is topographically subdivided into several aesthetic units. In facial rejuvenation, blending of the facial units is important in maintaining facial harmony.[1] Failure to treat any one region can detract significantly from an otherwise exceptional result. The restoration of an aesthetic neck contour is considered an integral component in facial rejuvenation.

Patients frequently express dissatisfaction with their neck contour during their initial consultation for facial rejuvenation. The anterior neck is often the first region to capture the eye of an observer when viewing an aging face. Characteristic signs of the aging neck include lipodystrophy, platysmal bands (lateral and medial), and nasolabial jowls that extend into the neck, reducing the aesthetic quality of the lower face. These deformities are the result of skin laxity, platysmal ptosis and redundancy, ptosis of the submental fat pad, and prominent submandibular salivary glands or digastric muscles. These deformities

may be compounded by a recessed chin and a prominent, low-set hyoid.

A combination of the above deformities may present a challenge for the surgeon striving to achieve a youthful neck during facial rejuvenation. We present our 15-year experience and evolution of an algorithmic approach in managing the cervical region, emphasizing multimodality techniques based on thorough knowledge of the pertinent cervical anatomy, dynamic and static analysis of the aging face and neck, and definition of the surgical goals and the operative principles necessary to achieve them.

ANATOMY

The anatomic limits of the neck are the inferior border of the mandible superiorly, the supraclavicular area inferiorly, and the anterior borders of the trapezius muscles laterally. The platysma originates from the fascia overlying the pectoralis and deltoid muscles and inserts in multiple points above the angle of the mandible.[2] Posterior fibers intertwine with the depressor anguli oris, mentalis, risorius, and the orbicularis oris before inserting at the level of the commissures. Central fibers insert directly into the periosteum of the mandible. Along its course, partial decussation of the muscle fibers is seen in approximately 61 to 75

Fig. 1. (*Left*) Preoperative view of a patient with wide platysmal bands. (*Right*) Preoperative view of a patient with narrow platysmal bands.

percent of the population.[3] When the muscle decussates from hyoid to chin, a supportive sling is fashioned for the submental area. Other variations include close approximation, but no decussation (10 percent), and total muscular decussation from mandible to thyroid (15 percent).[4] When the decussation of the platysma is absent, the free medial edges can be responsible for an anterior neck deformity, which appears as two vertical bands.[4,5] Retrospective analysis in our last 150 patients (unpublished data) reveals wide platysmal banding (Fig. 1, *left*) in approximately 70 percent, with the remainder being narrow (<2 cm) (Fig. 1, *right*).

The superficial cervical fascia is a continuation of the superficial musculoaponeurotic system and divides to envelop the platysma.[3] The platysma is bound to the skin by multiple dense connective tissue bands that anchor the superficial fascia to the underside of the dermis.[6] Other relevant structures in the neck include the submandibular gland, the digastric muscles, and the submental fat pad lying in an area bound by the inferior margins of the mandible.[3]

There are several nerve structures that must be protected from injury during cervical rejuvenation. The marginal mandibular branch of the facial nerve passes along the inferior border of the mandible and is covered along its course by platysmal fibers.[4] Anterior to the facial artery, the marginal mandibular nerve is always superior to the mandibular border.[7] The cervical branch of the facial nerve supplies the in-

nervation entering the deep surface of the muscle superolaterally and is often injured without knowledge. The incidence of injury to the cervical branch of the facial nerve during rhytidectomy was 1.7 percent in Owsley's series of 2002 patients.[8] Preservation of the platysmal function is important for facial expression, particularly during lower lip depression and expression of sadness, fright, or horror. Injury to the cervical branch can mimic marginal mandibular nerve dysfunction, but it can be distinguished from the latter by the fact that the patient will be able to evert the lower lip because of a functioning mentalis muscle.[8] The great auricular nerve is deep to the platysma inferiorly but is covered only by the superficial musculoaponeurotic system superiorly as it travels cephalad along the anterolateral border of the sternocleidomastoid muscle. It can be identified at a point approximately 6.5 cm inferior to the bony external auditory canal in the midtransverse belly of the sternocleidomastoid. Injury to this nerve produces numbness of the lower two-thirds of the ear and of the preauricular and postauricular skin. The external jugular vein is 0.5 cm anterior to the nerve.[9]

AESTHETIC NECK AND SURGICAL GOALS

Concise preoperative analysis and planning are indispensable in the management of patients presenting for facial rejuvenation. Defining the desired goals of the surgeon's intervention is integral in for-

mulation of the operative strategy. Ellenbogen and Karlin[10] established five visual criteria that are characteristic of the youthful, aesthetic neck in their postoperative rhytidectomy patients: (1) a distinct inferior mandibular border from mentum to angle, with no jowl overhang; (2) subhyoid depression; (3) visible thyroid cartilage; (4) visible anterior border of the sternocleidomastoid muscle, distinct in its entire course from mastoid to sternum; and (5) a cervicomental angle between 105 and 120 degrees (90-degree sternocleidomastoid to submental line).

In addition to Ellenbogen and Karlin's criteria, evaluation of the chin-neck relationship is essential if one is to ensure harmony of the aesthetic units of the lower face. Courtiss[11] incorporated chin augmentation in his series of patients undergoing suction lipectomy of the neck, reporting that the contour of the neck can be enhanced by improving the anterior jawline in profile. Byrd and Burt[12] defined the ideal chin projection to be 3 mm posterior to the nose-lip-chin plane. The nose-chin-lip plane was defined as a line extending from a point one-half the distance of the ideal nasal length through the upper and lower lip vermilion (Fig. 2).

PATIENT EVALUATION

The patient evaluation should begin with an assessment of the degree of skin laxity and the amount of preplatysmal fat. The submental and submandibular fat deposits should be palpated, and the presence of malpositioned or ptotic submandibular glands should be noted. A fat neck can obscure the ptotic glands, and patients must be aware of the pos-
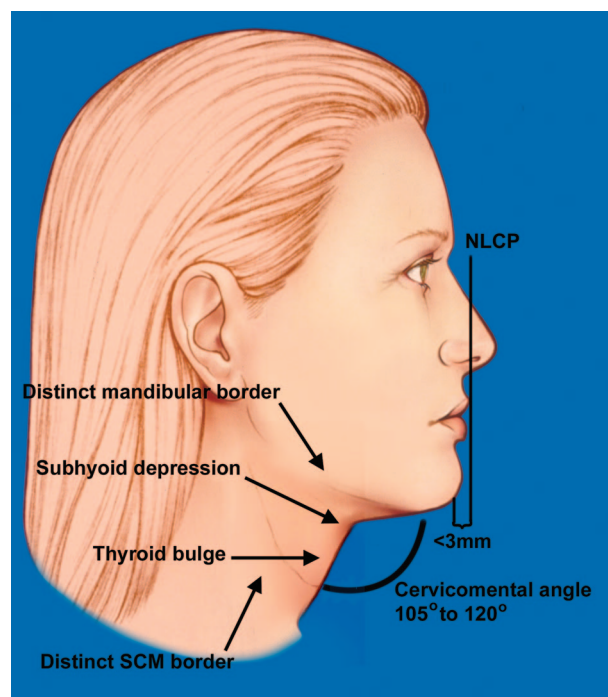
Fig. 2. The ideal neck and its measurements.

sibility of unmasking this deformity with the neck rejuvenation.

Dynamic evaluation of the neck begins during the initial patient interview. The surgeon observes the neck during normal conversation for deformities that plague the patient during the majority of daily activities. The patient is then asked to animate to display potential medial or lateral platysmal banding. Jowls may be present, and the contribution of the skin, sub-

Fig. 3. A standard facial photographic neck series, including anterior, lateral, and oblique views.

cutaneous fat, platysma, and submandibular gland to this deformity is assessed and recorded.

A standard facial photographic series, including anterior, lateral, and oblique views, should be obtained (Fig. 3). An additional view with the patient's neck flexed, as if reading, may also be helpful in revealing platysmal laxity.

On the basis of the preoperative evaluation, the majority of patients can be subdivided into four categories, the basis for the algorithmic approach (Fig. 4).

OPERATIVE STRATEGIES

Type I: No Skin Laxity, Excellent Skin Tone, and Lipodystrophy

The majority of patients in this category are young, that is, usually less than 30 years of age. They typically have congenital neck lipodystrophy and excellent skin tone and do not require rhytidectomy. The use of suction-assisted lipectomy (Fig. 5) and ultrasound-assisted lipectomy (Fig. 6), particularly in men, in this group of patients is an excellent treatment modality that can yield dramatic results.

Various authors[11,13–17] report a variety of mechanisms to explain the changes seen after suction- and ultrasound-assisted lipectomy of the neck. Nearly every conceivable technique has also been described to add to the confusion. Goodstein[14] reports subdermal suction with the cannula turned "upward," Samdal[15] takes care to keep the opening of the cannula "downward," while Courtiss[11] starts his treatment with the "opening directed outward," then turns it "inward" after formation of a single space. It is not clear from the literature whether the aesthetic result is due to the effect of ultrasound on skin ele-

ments, the amount of fat removed, the creation of multiple tunnels versus a single space, contractile healing of cannula tunnels, redraping of skin over areas devoid of fat, or the inherent elasticity of the skin. Given the excellent results with all of the aforementioned techniques, multiple mechanisms are likely involved and may never be definitively elucidated.

The incision is placed behind the submental crease, and standard infiltration with the superwet technique is performed. In cases where there is an unusually full neck, bilateral incisions anterior to the mastoid will allow for more aggressive and tailored contouring. We recommend superficial suction- and ultrasound-assisted lipectomy with small cannulas (2.4-mm Lambros cannula) using short radial strokes. Suctioning at the subdermal level is not recommended, because this may cause skin loss from injury to the subdermal vascular plexus, surface irregularities, pigmentary changes, and prolonged induration.[18–21]

Our experience with ultrasound- and suction-assisted lipectomy in this subset of patients has consistently yielded excellent results. This success, we believe, is due for the most part to careful preoperative analysis and patient selection. Unsatisfactory results may occur because of unrecognized medial platysmal banding or inadequate liposuction. Consideration may be given to some of the excellent nonexcisional approaches as described by Knize[22] and Ramirez.[23]

Type II: Mild Skin Laxity with or without Narrow Medial Platysmal Bands (<2 cm)

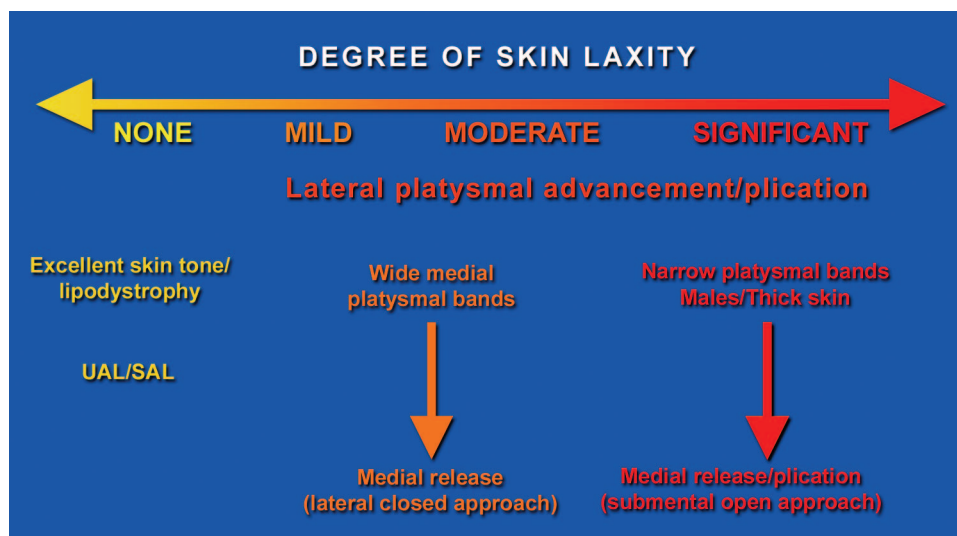These deformities are optimally addressed with wide medial and lateral neck undermining

Fig. 4. Algorithmic approach.

Fig. 5. Suction-assisted liposuction. Preoperative and 1-year postoperative views.

Fig. 6. Ultrasound-assisted liposuction. Preoperative and 9-month postoperative views.

from a lateral approach. The lax skin and poor platysmal tone require more extensive undermining to free the fibrous attachments of the superficial platysmal fascia from the dermis.

We use preauricular and postauricular incisions for access. To maintain a clean operating field and minimize blood loss during dissection, the subcutaneous tissue is infiltrated with superwet solution (30 cc of 1% lidocaine, 1 cc of 1:1000 epinephrine, and 1 liter of Ringer's lactate). Both the cheeks and submandibular regions are extensively undermined, joining the two skin flaps in the midline submental area using Gorney straight Supercut scissors (Fig. 7). All dissection is performed under direct vision using a fiberoptic retractor and manual countertraction. At least 3 mm of subcutaneous fat are left on the skin flaps to prevent noticeable skin irregularities, adhesions, and dimpling. Careful sculpting of the excess fat from the platysma is essential in defining the final postoperative appearance of the neck. Lateral platysmal plication to the sternocleidomastoid fascia is performed with multiple 4-0 Mersilene sutures (Fig. 8). After redundant skin is excised, the remaining skin is redraped without tension.

Free medial platysmal muscle edges will result in recurrent banding if they are left untreated. Our approach to this particular area mirrors the technique previously described by Knize[22] and Feldman.[24] The narrow platysmal bands are accessed through an incision placed 1 to 2 cm behind the submental crease. The inferomedial fibers of the platysma are incised for a distance of 1 to 2 cm, followed by reapproximation of the free medial edges with interrupted 4-0 Mersilene sutures (Fig. 9). No medial platysmal muscle fibers are removed. This medial imbrication allows for a smooth, regular submental contour. If the midline decussation is intact, imbrication of the muscle is performed to tighten the muscular sling and sharpen the cervicomental angle. The lateral platysmal fibers are plicated to the sternocleidomastoid fascia to eliminate redundancy in the muscle with poor tone. Aggressive resection of the submental fat pad is avoided to prevent the creation of a submental hollow and the subsequent "operated look."

Type III: Moderate Skin Laxity with or without Wide Platysmal Bands (>2 cm)

Midline plication of the patient with wide platysmal bands is not necessary. We perform transection of the inferomedial platysma at the level of the thyroid cartilage, but solely through a lateral approach. This obviates the need for a submental incision. After wide undermining and inferomedial platysmal transection, the cervical fascia anterior to the strap muscles is spread longitudinally with scissors to minimize the chances of recurrence. The platysma is then advanced posteriorly and plicated to the sternocleidomastoid with 4-0 Mersilene. If there is significant lipodystrophy, the supraplatysmal plane is directly defatted, leaving at least 5 to 8 mm of submental fat pad.

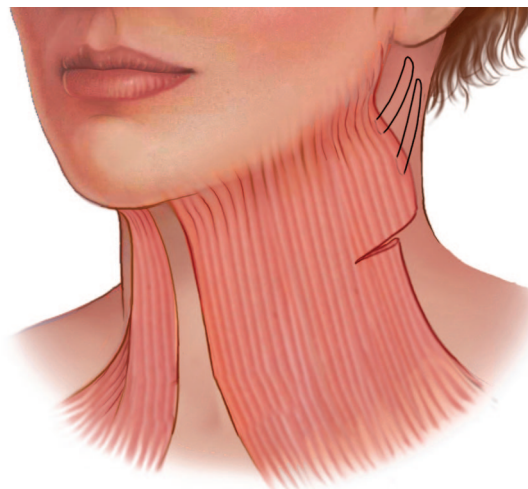**Fig. 7.** Undermining of the cheek and neck is shown in color.

Fig. 8. Only the same stitches from the lateral platysmal; no triangular wedges are taken out and there are no sutures in the midline.

Type IV: Moderate-Severe Skin Laxity and Significant Lipodystrophy

The approach to these patients is similar to the approach for the patient with narrow platysmal bands. This involves incision of the inferomedial and inferolateral platysma, with subsequent advancement and plication of the medial (submental access) and lateral platysma. Direct supraplatysmal defatting is also performed. In addition, to give greater definition to the body and angle of the mandible, a suspension suture (Vicryl) is placed from 1 cm below the mandibular border in the submental platysma to the mastoid fascia (Fig. 10). This suture helps define the neck from the cheek, provides support for the often ptotic submandibular gland, and assists in re-establishing the contour in the fat neck. This suspension suture is not recommended in thin-skinned individuals, because it may result in palpability or surface irregularity.

Fig. 9. The wedges are taken out and stitches are placed in the midline, with lateral platysmal sutures.

Fig. 10. Spanning suture from submental to mastoid.

CASE REPORTS

Case 1

L.R. was a 58-year-old woman who presented for facial rejuvenation with complaints of a "fat" neck. On examination, she had redundant skin with poor tone, significant jowls, and neck lipodystrophy, with loss of definition of the mandibular border and cervicomental angle. She underwent wide platysmal undermining, lateral platysmal plication, inferomedial platysmal incision with medial plication, and supraplatysmal defatting under direct vision. Suspension sutures from the submental area to the mastoid region were used for submandibular gland support. The cervicomental angle was recreated and the mandibular border definition was improved 2 years postoperatively (Fig. 11).

Case 2

P.B. was a 62-year-old woman who presented with the desire to eliminate her "jowls" and "loose skin" below her chin. On examination, she had poor skin tone and minor submental fat pads. She also demonstrated mild medial platysmal bands with animation. Her mandibular border was ill-defined, with a widened cervicomental angle. She underwent wide skin undermining, lateral defatting, inferomedial incision of the platysma, and plication via a submental incision. Two years postoperatively, she had a visible submandibular gland (Fig. 12).

MALE PATIENTS

Male patients often present with a greater degree of skin redundancy and tend to have a greater amount of recurrence of the aged appearance. These patients benefit from the inferomedial and inferolateral platysmal incisions and advancement/plication. Submental-mastoid suspension 3-0 Vicryl sutures are utilized liberally for additional support.

There are occasions when male patients, for a variety of reasons, do not wish to undergo traditional facial rejuvenation procedures. Instead, they may present with complaints of redundant submental skin, which they may find aesthetically unpleasing or causing difficulty with shaving and hygiene. In this circumstance, a direct anterior cervicoplasty is a reasonable alternative. Cronin and Biggs and other authors have described a number of direct approaches,[25–27] all including excision of some redundant skin and preplatysmal or subplatysmal fat. They vary in the extent and design of the skin incisions, as well as in the management of the platysma itself (imbrication versus Z-plasty). Regardless of the approach chosen, all authors emphasize the importance of informing patients of the scar that will result
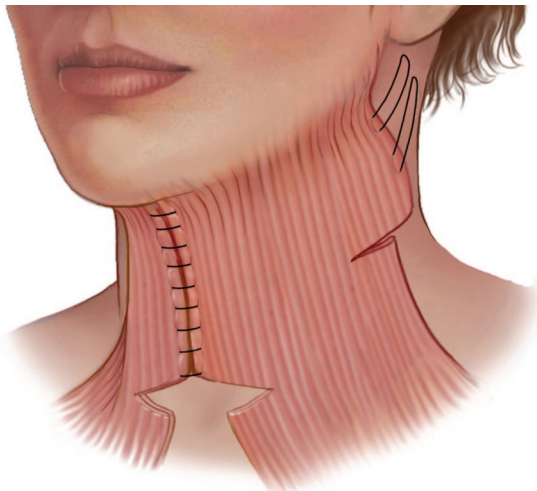
Fig. 11. Case 1. (*Left*) Preoperative views of a 58-year-old woman who underwent wide platysmal undermining, lateral platysmal plication, inferomedial platysmal incision with medial plication, and supraplatysmal defatting under direct vision. (*Right*) Two-year postoperative views.

Fig. 12. Case 2. (*Left*) Preoperative views of a 62-year-old woman who underwent wide skin undermining, lateral defatting, inferomedial incision of the platysma, and plication via a submental incision. (*Right*) Two-year postoperative views. Note the unveiled submandibular gland postoperatively.

Fig. 13. Case 3. (*Left*) Preoperative views of a 54-year-old man who desired facial rejuvenation and rhinoplasty concomitantly. (*Right*) Three-year postoperative views.

from the procedure. We have found direct anterior cervicoplasty to be a gratifying procedure in very select individuals, especially in patients who are small in stature and not surgical candidates for a face/neck lift procedure. Counseling of these patients includes a thorough informed consent process as well as photographs of similar excisions, to clearly define patient expectations preoperatively.

Case 3

J.D. was a 54-year-old man who desired facial rejuvenation and rhinoplasty concomitantly. He particularly complained of his "jowls" and "lack of any shape" to his cervical region. He underwent rhytidectomy, with cervical rejuvenation being accomplished with inferomedial and inferolateral platysmal incisions and advancement/plication. Submental-

Fig. 14. Chin augmentation, preoperative and 2-year postoperative views.

mastoid suspension 3-0 Vicryl sutures were placed bilaterally (Fig. 13).

PROMINENT SUBMANDIBULAR GLANDS

Prominent submandibular salivary glands may be unmasked after local lipectomy and elimination of platysmal flaccidity. Resection of the gland has been described by de Pina and Quinta[28] and may be performed at the time of neck rejuvenation, if the deformity has been identified preoperatively. Resection can also be performed via a direct access incision if the deformity is noted after the resolution of postoperative edema. In either case, care must be taken to protect the marginal mandibular branch of the facial nerve. Potential significant complications of this procedure include local infection, salivary fistula, damage to nerve, and severe bleeding. We do not perform excision in light of the potential sequelae, and opt instead for the submental-mastoid suspension suture, as previously described. If greater support is desired, a 4-0 polydioxanone suture can be used to imbricate the platysma inferior to the gland to suspend it in a more cephalad position.

CHIN

The chin should be considered whenever facial rejuvenation is considered. Inadequate chin projection may detract from the aesthetic result of an otherwise superb facial rejuvenation procedure. Improvement in contour and definition of the cheek and neck can be accom-

plished with implants or osseous advancement (Fig. 14).

NONOPERATIVE STRATEGY

Not all patients with cosmetic neck deformities warrant surgical intervention. The 45- to 50-year-woman with prominent platysmal banding and horizontal rhytides, little or no skin excess, and no need for other facial rejuvenation is the classic example. These patients are excellent candidates for injection with botulinum toxin type A (Fig. 15). Matarasso et al.[29] injected an average of 50 to 100 units of exotoxin (maximum, 250 units) into 1500 patients and achieved the best results in patients with mild to moderate horizontal neck rhytides, thin or thick platysmal banding, and mild to moderate skin laxity. Kane[30] reported the injection of 5 to 20 units of exotoxin per band, depending on its relative thickness, with similar findings. All authors agree that injection with botulinum exotoxin type A is not appropriate for patients with skin redundancy, excess fat, or hypertrophic submandibular glands. Matarasso et al.[29] warn that the use of exotoxin in the patient with loose platysmal cords can result in a worsened neck deformity. The reported complications include dysphagia with high doses (mean dose, 184 units), edema, ecchymosis, muscle soreness, neck discomfort, and neck weakness.

We have found it unnecessary to use the large dosages reported by Matarasso et al. Our approach more closely resembles that of Kane.[30] The platysma muscle is grasped between the

Fig. 15. (*Left*) Before botulinum exotoxin type A injections. (*Right*) Two months after injection.

thumb and index finger of the surgeon's non-dominant hand, distracted, and then injected with 2.5 units of botulinum toxin in 1-cm intervals. This injection is repeated every centimeter throughout the length of the band. Normally, 10 to 15 units are needed for the average patient with platysmal banding.

Other indications for the use of botulinum exotoxin type A include older patients who are not surgical candidates and patients who have undergone previous neck rejuvenation and now have recurrent platysmal bands without skin excess.

DISCUSSION

"Less is more" is the current trend in facial rejuvenation. We have come to realize that defatting and skeletonization, once performed routinely, leave the patient with a "hollowed out" or "operated" look. These features are undesirable and may accentuate fat atrophy, contributing to the impression of an aging face. The focus has turned to the contouring and resuspension of deeper structures to impart a youthful, fuller appearance.

Whether it is an isolated deformity in a younger patient or a component of rejuvenation of an aging face, a youthful-appearing neck is essential in maintaining the balance and harmony of the lower face. Numerous articles highlighting subtle nuances in technique can leave the neophyte plastic surgeon bewildered when he or she is presented with an aesthetically unappealing neck. As is the case with all plastic surgical procedures, careful and detailed preoperative analysis

of the deformity is crucial in formulating a logical and effective operative strategy. In this article, we detail an algorithmic approach to a number of neck deformities based on accurate preoperative analysis. Accurate analysis and application of techniques to correct specific anatomic derangements will allow the surgeon to achieve consistent and reliable results.

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DISCLOSURE

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