ANATOMY

Initial evaluation of the aging face begins with topographic anatomy. In simplistic terms, the shape of the human face is composed of a skeletal bony framework that is covered by a soft tissue envelope. Overall skeletal proportions are probably the most important component of facial attractiveness. However, skeletal proportions are relatively fixed and can only be slightly altered by bony alteration or implants. For practical purposes, facial cosmetic surgery focuses on the soft tissue envelope. Surgical facial rejuvenation has two lines of approach: facial contours and skin surface quality. This review will be limited to surgical methods for improving soft tissue contours in the aging face.

Essential Basic Anatomy

All faces, young or old, contain similar anatomic components. Beneath the surface skin of the cheeks lies subcutaneous fat. The fat layer lies both superficial and also deep to the mimetic muscles. This fat layer allows the facial mimetic muscles unrestricted gliding. The orbicularis oris and orbicularis oculi muscles, however, do not have a significant encasing subcutaneous fatty layer. This arrangement allows them to effect complex and detailed surface movement of the lips and eyelid. The facial fat appears to be segmented into discrete lobules, which are partitioned by fascial septae that contain...
vascular structures. How these vertical compartments relate to the horizontal partitioning of the superficial musculoaponeurotic system (SMAS) in the midcheek remains unclear.

Mimetic Muscles

The mimetic muscles of the cheek are divided into a superficial and a deep layer. The superficial layer includes the zygomaticus major and minor, the levator labii superioris, risorius, and the depressor anguli oris, along with the orbicularis oculi and orbicularis oris. The deep layer of mimetic muscles is composed of the levator anguli oris, buccinator, depressor labii inferioris, and mentalis. There is considerable variability in the pattern of the upper cheek mimetic muscles, with the most common pattern being a levator alae nasi, levator labii superioris, and a single zygomaticus muscle (44%).

SMAS

A subcutaneous fascia partitions the superficial subcutaneous facial fat. Anatomically, this fascia was recognized as early as 1799, when it was referred to as a cellular membrane. In 1859, Gray described the layer as the superficial subcutaneous fascia. In 1960, the usefulness of including the subcutaneous fascial layer in plicating sutures was noted. Later that decade, Tessier and Skoog, apparently working independently in France and Sweden, respectively, described the benefit of undermining and imbrication of this fascial layer in facelifts. Residents from Tessier’s unit then performed a number of anatomic studies to define the extent of the superficial subcutaneous fascia. Their classic anatomic study, published in 1976, described a superficial subcutaneous fascia that invested the platysma muscle and fused to the external surface of the parotid fascia. They named this fascia the SMAS. These findings have been corroborated by other authors, but the original study was not able to define the exact anterior extent of the SMAS.

One of Tessier’s residents later challenged this concept. He contended that there was no distinct parotid fascia and that the SMAS, rather than being an extension of the cervical investing fascia, was an embryologically distinct “primitive platysma.” Controversy over the exact nature and extent of the SMAS continues to exist. However, the consensus of surgical opinion seems to be that the SMAS represents the facial extension of the cervical investing fascia. As such, the SMAS envelops the platysma in the neck and cheek. Anteriorly, the SMAS becomes attenuated but terminates as the investing layer of the superficial layer of the mimetic muscles (Figure 1). Laterally, the SMAS fuses with the multilayer parotid capsule. Superiorly, the SMAS passes over the zygomatic arch to join the superficial temporal fascia (temporoparietalis and galea).

Retaining Ligaments

In order to avoid the displacement by shear forces and gravity, the soft tissues of the body must be anchored to the bony skeleton. Muscles are secured by originating and inserting from bony attachments. The fatty mass and skin receives some cutaneous extensions from the muscle fascia, but the mobile subcutaneous mass is otherwise vulnerable. This dilemma is apparently solved by the presence of osseocutaneous ligaments passing directly from the dermis to the periosteum in bare areas between muscle origins. These have come to be referred to as retaining ligaments.

The most prominent of these retaining ligaments in the cheek are the zygomatic, parotid, mandibulocutaneous, and zygomaticocutaneous (malar membrane) ligaments (Figure 2). Along the border of the mandible exists a membrane (the “mandibular septum”) that appears to partition the cheek fat from the neck.
The Nerves

The facial nerve (cranial nerve VII) exits the stylomastoid foramen, separates into an upper and a lower division as it passes through the parotid gland, and distributes to the facial muscles. In most cases, the motor branches of the facial nerve innervate the mimetic muscles from their deep surfaces. Several peculiarities of the distribution of cranial nerve VII are particularly relevant to facial surgery. In the mid-cheek, an arcade connects the branches of the upper with the lower divisions approximately 70% of the time. This connection provides an element of reserve capacity in the event of injury (Figure 3). By contrast, both the frontal branch of the upper division and the marginal mandibular branch of the lower division are more likely to be terminal and uncollateralized. Therefore, they are less forgiving of injury.

The position of the marginal mandibular branch of the facial nerve was classically described as being above the mandibular border, anterior to the facial artery, in 81% of cadaver dissections. Live surgical dissections, however, have shown the marginal nerve branches to course as low as 4 cm below the mandible, particularly posterior to the facial artery. Topographically, the frontal branch of cranial nerve VII follows a course from 0.5 cm below the tragus to 1.5 cm above the lateral brow. Within the cheek, the nerve lies deep to the SMAS over the zygomatic arch, then continues upward within the temporoparietal fascia (Figure 4).

Pertinent sensory innervation to the cheek and ear involves three sets of nerves. The auriculotemporal sensory nerve sends superficial branches to the preauricular skin. From the cervical plexus, the great auricular nerve courses superiorly to innervate the lower portion of the ear. Finally, branches from the lesser occipital nerve innervate the upper portion of the ear.

PATIENT EVALUATION

Before making a decision regarding the feasibility of a surgical plan, some prerequisites require evaluation. First, does the patient have concurrent health issues that would preclude safe surgery? Severe cardiovascular or cerebrovascular disease would be an example of such an issue. We must always be cognizant that because cosmetic surgery is elective, the acceptable health risk is minimal. Second, is the patient’s goal appropriate and achievable? At times of personal crisis, some patients seek to solve life problems through surgery. In addition, there are some patients whose assessment of the problem is out of proportion. Finally, there are patients with uncorrectable problems. Assuming that the patient is both healthy and appropriate and that the anatomic problem is correctable, attention can then be turned to the surgical plan.

Aging Changes

Aging affects both the facial skeleton and the facial soft tissues. With age, the lower orbital rim and the dental alveolar bones tend to resorb. Soft tissue...
aging appears to have two mechanisms: deflation and descent. Both result in a relative excess of facial skin.

The classic effects of descent are shelving of the nasolabial fold, ptosis of the malar portion of the superficial fat, and accumulation of fat at the mandibular jowl. Deflation (that is, the resorption of facial fat) seems to occur in many patients. It appears to be most common in patients who have had lifelong thinness in their face. The atrophy seems to occur throughout the face in the periorbital, buccal, and perioral regions.

INCISIONS

Two common variations are available for the preauricular incision: pretragal and posttragal. The classical pretragal approach is still preferred by some surgeons, particularly in patients with heavy beards, because this type of incision avoids transferring hair-bearing skin onto the tragus. It also lessens the likelihood of tragal distortion by traction or a thickened cheek flap. In patients with uniformly pigmented, non–hair-bearing skin, a posttragal incision may be preferred. When carefully closed, it avoids a noticeable cheek scar.

Recent modifications have centered on minimizing the mastoid scar. Particularly when the mastoid skin is closed under tension, a poor-quality scar can occur. As a result, the scar may limit the patient’s hair style. The purpose of the mastoid incision is to allow for the posterior removal of excess neck skin. In patients with minimal neck excess, a short scar technique can be employed. By advancing the cheek flap vertically rather than horizontally, the mastoid excess can be limited. The tradeoff, however, may be extension of the anterior scar up the temporal hairline. Bevelling and zig-zagging the coarse sideburn hair may produce an acceptably subtle scar. However, further extension of the temporal recess superiorly into the fine hair can leave a noticeable scar.

The opposite of the short scar approach to minimal neck excess is the management of the patient with excess of the neck skin. To avoid residual vertical skin banding, posterior skin advancement and excision is necessary. In cases of moderate skin excess, extension into the occipital hair can be used. In patients with marked excess neck skin, however, it may be preferable to extend the mastoid scar down the posterior hairline.

SURGICAL OPTIONS

The fascination of facial cosmetic surgery is that it is not standardized. As with all art, it depends on subjective judgments made by the patient and the surgeon. As a result, there are many different approaches.
**Subcutaneous Facelift**

The first recorded attempts at surgical facial rejuvenation were multiple excisions without undermining. The limitations of excision alone were soon recognized. As a result, subcutaneous undermining, followed by advancement and excision of redundancy, became the standard procedure.

A preauricular incision provides access to the surgical dissection plane. The incision is extended around the earlobe into the mastoid if neck redundancy is to be addressed. The subcutaneous dissection is continued anteriorly to a variable extent, after which the redundant skin is advanced upward and laterally, where redundancy is excised. Jowl and/or nasolabial fat sculpting is carried out under direct vision.

The subcutaneous facelift is still widely used, especially in patients with thin faces or those who require defatting. The pure subcutaneous facelift, however, has two potential limitations. First, because dermis is a viscoelastic structure, it is subject to stress relaxation. Placing excess tension on the skin can lead to a “stretched” appearance. Second, simply redraping the surface skin does not address repositioning of the facial fat.

**Subcutaneous Facelift With Suture Plication**

In an effort to enhance the benefit of skin redraping, supplemental suspension of the subcutaneous fatty mass was added. Initial attempts were made with spanning sutures placed as loops from the anterior cheek fat to the temporal area. For some reason, these early attempts with spanning subcutaneous sutures never gained wide acceptance.

The second method of subcutaneous suspension involved more direct folding plication. An oblique line of plication extended from the orbital rim to the base of the ear lobule. The value of anterior placement of the plication over the mobile SMAS stimulated its inclusion in a number of procedures, including the SMASectomy and the component facelift. Variations of that mechanical approach are still commonly used.

An alternate method of suture plication employs suture loops that pass through the anterior–inferior subcutaneous tissues and are suspended to the zygomatic or temporal area. The method was employed in the early twentieth century, but it never became popular. A resurgence of interest in suspension sutures occurred with the S-lift. In this procedure, the loops are tightened in a “purse string” effect to elevate the cheek fat in a vertical direction. The S-lift has since been modified into the MACS lift (Figure 5).

These techniques have enjoyed a resurgence as surgeons endeavor to minimize the extent of and recovery time for facelifts. Initially directed only at the mild lower facial deformities, these techniques have been extended to address both the malar and brow areas.

The advantages of the loop procedures include the avoidance of the need for deep dissection to the SMAS and platysma, and an emphasis on a vertical (rather than horizontal or oblique) skin vector. Advocates argue that the degree of facial repositioning with plication is equal to that of imbrication. The potential deficiencies of the technique are the historical loss of benefit caused by suture tear-through of the gathered tissue and the limited removal of neck and temporal redundancy.

**Subcutaneous Facelift With SMAS Imbrication**

The surgical value of dissection in this procedure was not widely accepted until the 1974 book *Plastic Surgery—New Methods*, by Tord Skoog. Unfortunately, Skoog died before he was able to refine his surgical procedure. However, a variety of surgeons recognized the potential of the superficial subcutaneous fascia to suspend the composite cheek skin and fat.

Two different schools of thought developed regarding SMAS procedures. One maintained the original method of moving the skin and subcutaneous fat as a single composite layer, which was mobilized in a vertical vector. Several variations of the procedure have been developed, including composite rhytidectomy and the high SMAS (Figure 5). The other school adopted a two-layer approach in which skin dissection is combined with a separate SMAS dissection. The two-layer approach allowed vertical mobilization of the SMAS fat layer associated with a more horizontal advancement of the cheek skin. After initially focusing on the low SMAS below the level of the zygomatic arch, these two-layer procedures were later modified to extend the dissection into the malar area.

Sub-SMAS dissection has been approached in several ways. Initial attempts consisted of timid dissections of the lateral SMAS. In this area, fixation of the SMAS to the parotid capsule (the so-called fixed SMAS) does not achieve cheek motion. Mobilization of the SMAS requires anterior dissection into the buccal area, where an areolar plane exists—the mobile SMAS. The key to effective mobilization is to advance the anterior mobile SMAS back or upward to the fixed SMAS. This advancement can be achieved either by extension of the lateral SMAS dissection from over the parotid anteriorly or by making the initial SMAS incision anterior to the parotid capsule. Dissection into the area of the mobile SMAS is critical for cheek motion. However, the anterior SMAS investment of the zygomaticus major muscle still remains. The achievement of maximum effacement of the nasolabial fold is benefitted by release of the zygomaticus major investing fascia.

The advantages of the SMAS dissection procedures include extensive release of restrictive SMAS attachment and the power of imbrication (undermining to facilitate advancement) versus plication (inrolling without undermining). The other advantage is a specific fascial suspension of the subcutaneous cheek mass. The disadvantage of the sub-SMAS approach is a more complex dissection with potential risk to facial nerve branches.
Temporal Approach

As an offshoot of experience with craniofacial surgery, two variations of the temporal approach to the upper face developed: subperiosteal and supraperiosteal. The major difference between the techniques relates to undermining and detachment of the origins of the facial mimetic muscles from the zygoma and maxilla. Although it affords a dissection plane deep to any nerve branches, the subperiosteal approach\textsuperscript{108-115} detaches the origins of the mimetic muscles. Apparently, rapid reattachment occurs without noticeable alteration of facial expression. The supraperiosteal approach\textsuperscript{116-119} leaves the origins of the cheek mimetic muscles undisturbed, but places the nerve branches deep to the muscles at greater risk. Both techniques afford direct access to the periorbita and malar fat, but the lower facial tissues must be addressed with a separate procedure. With the approach attempting to move the cheek mass more than the periorbital area, unwanted lateral canthal distortion can occur.

Malar Lift

Direct suspension of the malar (midface) area through a lower blepharoplasty incision has also been described.\textsuperscript{120-123} Through a subciliary incision, a subperiosteal dissection is carried down over the zygoma and maxilla. The infraorbital nerve is spared and the periorbita and malar fat, but the lower facial tissues greater risk. Both techniques afford direct access to the periorbita and malar fat, but the lower facial tissues must be addressed with a separate procedure. With the approach attempting to move the cheek mass more than the periorbital area, unwanted lateral canthal distortion can occur.

Percutaneous Threads

Initially designed for reconstruction, barbed sutures\textsuperscript{124-127} were adapted to cosmetic suspension of the cheeks with the invention of the APTOS sutures.\textsuperscript{128-130} These sutures were placed originally as linear or curvilinear threads with the axis vertical-oblique.\textsuperscript{131,132} Subsequently, the method has been modified to allow for the percutaneous placement of barbed suture loops that are secured to the temporal fascia. In theory, the barbs—as opposed to smooth suture plication loops—provide more points of soft tissue fixation. In addition, relatively little patient down-time is experienced with the closed technique. Limited duration of benefit and occasional extrusion have limited acceptance of the technique.

Fat Injection

While isolated attempts at filling facial defects with fat existed previously, it was not until the 1990s that loss of facial fat as a component of aging was emphasized.\textsuperscript{54,55,133,134} Deflation of volume, particularly in the periorbital, cheek, and perioral areas, plays a prominent role in creating facial hollowness and skin laxity. More recently, specific compartments of facial fat have been identified.

Conceptually, the removal of body fat from unwanted locations and subsequent reinjection into areas of facial atrophy is ideal.\textsuperscript{135-140} However, the limiting factor is the fragility of the transferred fat, which results in unpredictable viability.\textsuperscript{141,142} Fat viability is influenced by several factors, including the method of harvest, cleansing, particle size, and reinjection cannula size. Minimizing extraction vacuum pressure causes less immediate cell trauma. Smaller harvested cannulae should match the injection cannula to minimize transfer compression. Cleansing to remove traumatic products can be accomplished through rinsing or centrifugation. Finally, the trend is toward increasingly smaller injection particles to minimize lumpiness and increase surface area. An extensive review of the science of fat grafting was published in 2008.\textsuperscript{142}

The most common areas of fat injection are the cheeks and nasolabial folds, where tissue is thicker and muscle movements are more minimal. Periorbital injections are another option, but very fine particles are necessary to avoid lumping. The perioral area and lips are the least predictable in retention, presumably because of underlying muscle movement.

THE NECK

Considerable variation occurs in patients’ necks. First, overall neck shape is determined by the skeletal and laryngeal configuration. For practical purposes, patients can be divided into two groups: those with long, thin necks that develop visible platysmal bands, and those with obtuse necks and a poor cervicomental angle. The ideal neck configuration has been described as having a cervicomental angle of 105° to 120°, with a distinct mandibular border.\textsuperscript{123}

The Thin Neck

The pathogenesis of platysmal banding in the long, thin neck is still not agreed upon. Initial anatomic studies focused upon decussation of the fibers from one side to the other, across the midline.\textsuperscript{144,145} While the two classic studies did not have the same findings, both found minimal decussation below the level of the hyoid bone. The platysma muscle in the neck is enveloped by layers of the cervical investing fascia. The platysma runs from the cheek to the clavicle, across the curve of the
The resurgence of lateral and upward traction approach has gained popularity. Suturing to the periparotid fascia has been advocated. This lateral and upward traction approach has evolved when surgeons began placing the incision in the submental area. The platysma was then closed in the midline. This approach evolved when surgeons began placing the incision in the submental area.

Gradually, the approach to the anterior platysma focused on two maneuvers. First was an upper neck approximation of the anterior platysmal bands in conjunction with lateral platysmal suspension. This combined anterior–posterior suspension created a hammock effect to support the neck contour. The second portion of the anterior approach involved partial or complete transection of the midplatysma to interrupt the vertical banding.

Partial lateral transection, partial medial transection, and complete transection are common variations. Low medial partial transection has persisted to prevent medial banding in procedures that approximate the anterior platysma. Partial lateral transection may facilitate a vertical SMAS elevation. Complete transection of the platysma has received diminished interest because of late superior retraction (“window shading”) and is usually reserved for very obtuse necks where maximum sculpting is needed.

The anterior-only approach to platysmaplasty in thin necks has been advocated in the platysma corset technique. After elevating the neck skin, the medial edges of the platysma are infolded with multilayer continuous sutures. The concept is that because the lateral cervical investing fascia usually remains strong with aging, elevation of the neck sling can be accomplished by medial tightening against fixed lateral attachments. The redundant neck skin can either be allowed to contract or it can be excised laterally. The advantage of this technique is that the medial closure is very firm. This avoids the late dehiscence of the medial band closure commonly seen when only a few isolated sutures were used. Critics of the procedure argue that the strong anterior tension works against elevation of the SMAS in the cheek.

As a temporizing step to delay definitive surgery or as a supplement to previous surgery, the anterior bands can be injected with botulinum toxin. This technique generally involves grasping the band to distract it away from the neck. Serial injection of approximately 5 IU of exotoxin per site in several sites along each vertical platysmal band is performed. Most commonly, a total of 40 to 100 IU is used. The technique works best in younger patients with more active than passive bands and in patients with tighter skin. Rare dysphagia, presumably from deep spread of the exotoxin, has been reported.

The Obstuse, Fatty Neck

An obtuse cervicomental angle can be caused by (1) a low position of the hyoid bone; (2) loose, excess skin; (3) excess preplatysmal fat; and (4) excess subplatysmal fat.

The position of the hyoid bone can influence the overall shape of the neck. In the patient with a desirable cervicomental angle of 90° to 110°, the hyoid lies vertically in line with the fourth cervical vertebrae. In patients with an obtuse cervicomental angle, the hyoid projects inferior to the fourth cervical vertebrae.

The most common method of surgical contouring of the obtuse neck is removal of the preplatysmal fat. The fat may be excised through a submental incision or aspirated by liposuction. Defatting can be carried out safely as long as the dissection remains external to the platysma because the marginal mandibular branch of the facial nerve courses deep to the platysma. When performed in conjunction with a facelift, it is important not to carry the defatting too high over the mandibular border because later elevation of the cheek skin can produce a skeletonized mandibular border. It is also important to remember that the normal, aesthetically pleasing neck has an obligatory layer of subdermal fat. This fat provides not only a smooth contour, but also a gliding plane over the platysma. Care must be taken not to over suction necks because that can produce an unnatural appearance.

The removal of subplatysmal fat has been more controversial. In many patients with obtuse neck configuration, excess fat is also present beneath the platysma. This fat lies in the midline and extends out to the medial border of the submandibular gland. Judicious reduction of the excess subplatysmal fat may enhance neck contouring, but secondary submental hollowing has been a frequently reported sequela. There is no doubt...
that this visible hollowing results from inadequate approximation of the medial platysmal borders with subsequent dehiscence. Therefore, if one is to undertake subplatysmal fat removal, it behooves the surgeon to perform a secure midline closure over the deficit.

In a subgroup of patients, only anterior contouring is necessary. These patients have been divided into three categories: (1) patients with obtuse cervicomen- tal angles and good skin elasticity; (2) patients with subplatysmal fat or mild to moderate skin and muscle laxity; and (3) patients with severe skin laxity who wish to have a limited procedure. The first group consists mainly of young patients in whom either liposuction alone or open liposuction with platysmaplasty will suffice. The second group are usually middle-aged patients in whom aggressive anterior contouring can be performed while allowing skin contraction. The last group consists mainly of older male patients with more limited goals who are willing to accept the cervical scar of anterior skin excision.

A subgroup of patients with obtuse necks have ptosis of the submandibular gland, creating a visible bulge below the mandibular border. A variety of methods for dealing with the ptotic gland have been described: partial resection, suture suspension to the mandible, and transcervical suspension sutures. Surgical manipulation of the submandibular gland has not achieved general acceptance because of the risk of hematoma from glandular vessels and potential injury to the marginal mandibular branch of the facial nerve.

**PREOPERATIVE PREPARATION**

**Intercurrent Illnesses**
Preoperative preparation entails control of intercurrent illness. Blood pressure, diabetes, and other chronic systemic illnesses should be well controlled. A blood pressure of 140/90 mm Hg or less is desirable. It should be noted that the diastolic pressure is the most important indicator in the preoperative setting. Some nervous patients develop systolic pressure elevation (widening of the pulse pressure) related to stress. Often, this transient elevation subsides with sedation. It must be kept in mind that cosmetic surgery is electively performed in healthy people to enhance quality of life. The acceptable biologic risk is therefore minimal.

**Platelet Inhibitors**
The second area of patient preparation involves the avoidance of influences that can cause surgical bleeding, usually by interfering with platelet function. We live in an era in which dietary supplements are popular. While these supplements may be beneficial when the body is in homeostasis, many patients have the mistaken impression that these supplements can enhance surgical healing.

Among the supplements that should be discontinued two weeks before elective surgery are Arnica montana (arnica), Angelica sinensis (dong quai), echinacea, Ephedra sinica, Tanacetum parthenium (feverfew), garlic, gingko, biloba, ginseng, Hydrastis canadensis (goldenseal), Piper methysticum (kava kava), licorice, omega-3 fatty acids (fish oils), saw palmetto, St. John’s wort, valerian root, Camellia sinensis (green tea), and vitamin E.

A number of medications also interfere with platelet function. The classic example is aspirin, which is an irreversible cyclooxygenase (COX-1 and COX-2) inhibitor. Most other nonsteroidal antiinflammatory drugs (NSAID) act reversibly, mainly on COX-1. Inhibition of the COX-1 enzyme retards the formation of prostaglandin, prostacyclin, and thromboxane, which are inflammatory mediators that damage platelet function. Selective COX-2 inhibitors such as celecoxib do not affect platelet function. Acetaminophen is now thought to be a COX-3 inhibitor that works by a separate central mechanism, but also does not adversely affect platelets.

Common NSAID products that could cause surgical bleeding include fenoprofen, flurbiprofen, ibuprofen, indomethacin, nabumetone, and naproxen. NSAID use should be discontinued at least two weeks before elective cosmetic surgery.

Should excessive capillary bleeding occur during surgery in a patient suspected of covertly taking aspirin or NSAID medications, prothrombin time, activated partial thromboplastin time, and platelet count should be tested. However, a platelet function analysis (PFA-100) can be performed as a rapid screen for aspirin or NSAID use as the cause. In severe bleeding, intravenous desmopressin has been shown to be of benefit.

**Smoking**
The other category for avoidance is smoking, because “tobacco smoke is an aerosol of particulate matter, volatile acids and gases. The overall cellular effect of these inhaled or absorbed byproducts is to produce an environment of relative tissue hypoxia, and delayed wound healing mediated by vasoconstriction, abnormal cellular function, and thrombogenesis.” It has been reported that the incidence of facelift skin flap necrosis is 12.5 times greater in smokers than nonsmokers. There seem to be two mechanisms responsible for this increase in necrosis. Chronically, smoking causes a permanent obliteratorative endarteritis similar to Buerger disease. Acutely, smoking one cigarette has been shown to cause temporary vascular spasm lasting up to one hour, which resulted in a 24% to 42% reduction of blood flow in the hand.

The current recommendation is that patients remain nicotine-free for four weeks before surgery and for four weeks after surgery. Because nicotine creates a very strong addiction, sudden withdrawal is often unsuccessful. A temporary step-down regimen is usually
more successful. Smoking is initially replaced by nicotine gum or a transdermal patch, which is gradually decreased over several weeks. Psychotherapeutic drugs such as bupropion hydrochloride or varenicline tartrate may facilitate compliance.

Because of the strong addictive nature of nicotine, patients may underreport their smoking frequency. Cotinine, the metabolic breakdown product of nicotine, can be detected for up to four days after smoking.195 The standard cotinine test has been urinary (liquid chromatography/mass spectrometry),196 but a salivary rapid test (NicAlert cotinine test strips; Jant Pharmacal, Encino, CA) has recently been developed and found to be just as accurate.197,198

POSTOPERATIVE CARE

Postoperative management is divided into the immediate postoperative period (the first 24 hours) and the subsequent period. Immediate postoperative care centers around avoidance of hematoma through good blood pressure control. Again, for practical purposes, the systolic blood pressure level is more indicative than the diastolic. Maintenance of a postoperative systolic pressure of less than 140 mm Hg is desirable.

Intraoperative treatment with a clonidine transdermal patch of 0.1 to 0.2 mg will often blunt the hypertension associated with the injection and, later, the absorption of the adrenalin in the local anesthetic solution. In patients who are not on blood pressure medication (particularly beta blockers), intraoperative hypertension can be controlled with 5- to 10-mg boluses of labetalol. It is important to avoid adding additional beta blockers in patients who are already beta-blocked and showing relative bradycardia. In such patients, 0.25-mg boluses of a calcium channel blocker such as nicardipine can be given intraoperatively. Injected adrenalin from the local anesthetic solution is slowly absorbed, such that postoperative hematomas usually occur four to 10 hours after surgery. Postoperatively, labetalol can be administered orally in doses of 100 mg. Alternatively, a pure alpha agonist (such as clonidine 0.1 to 0.3 mg) can be administered orally.

Prolonged postoperative swelling can cause stress relaxation of the facial skin and lead to a compromised result. The degree of postoperative swelling is related to the extent of dissection rather than the depth. Limited salt intake (preferably to 1000 mg/day) and minimized fluid intake may also be of benefit. The potential value of perioperative corticosteroids has remained controversial. While craniomaxillofacial surgeons have felt they were beneficial,199,200 others have not found significant benefits for facelift swelling.201,202

Subsequent postoperative care centers on suture line care and eye lubrication if a simultaneous eyelid procedure has been performed. The majority of the noticeable swelling is in the lower eyelid rather than in the face and neck.

COMPLICATIONS

Hematoma

The most common early complication of facelift surgery is hematoma. Adrenalin injected in the surgical dissection plane for hemostasis is absorbed postoperatively. Such absorption can lead to rebound hypertension and hematoma. The incidence in nonhypertensive patients is approximately 3%,203 but the incidence rises to approximately 8% in hypertensive patients and in males.204 The incidence of hematoma is also increased in patients ingesting platelet-inhibiting medications or supplements. The prototypic platelet inhibitors are aspirin and other antiinflammatory medications.

The influence of adrenalin in local anesthetic solutions has been implicated in wound bleeding. While the classical mixture for small area infiltration has been 1:100,000, complications can arise in larger volumes. Dilutions as low as 1:800,000 have been shown to give adequate hemostasis.205 One report describes tumescent infiltration (200 mL per facial side) with no adrenalin as greatly reducing postoperative hematomas without significantly increasing wound bleeding or facial edema.206

Skin Necrosis

The incidence of skin necrosis varies from 1% in sub-SMAS procedures to 3.6% in skin flap facelifts.203 The incidence is significantly higher in patients with vascular occlusive disorders, particularly smokers.203,207

Infection

Wound infections are very rare in facelift surgery. Preauricular infections are often a result of otic canal Pseudomonas aeruginosa carriers.208 Avoidance of preauricular skin infection may be reduced by the use of gentamycin ointment in the ear canal. If present, the Pseudomonas infection usually responds to drainage and oral ciprofloxin.

There is also widespread infestation with nasal Staphylococcus aureus. Reports of random testing have shown nasal carrier rates of 21.5% for methicillin-sensitive S aureus and 5.6% for methicillin-resistant S aureus (MRSA) strains.209 In patients known to be carriers or those at high risk (healthcare professionals), nasal and ear canal cultures can be taken for screening. If present, eradication can be achieved by administration of topical mupirocin ointment for seven to 10 days and chlorhexidine soap body washes for five days.201 Postoperative MRSA infections are treated by oral or intravenous vancomycin.

Nerve Injury

The frequency of permanent facial nerve injury is also very low. Historically, the incidence in skin-based facelifts was less than 1%. Very few permanent facial nerve injuries have been reported with sub-SMAS dissections.203 The most commonly injured branches are buccal,
but they are more forgiving because of rich collateralization of the branches. The temporal (frontal) branch and the marginally mandibular branch are less forgiving, because they are more likely to be terminal branches.212

**ADJUNCTIVE PROCEDURES**

The facelift procedure—even with the inclusion of the brow, eyelids, and neck—does not address the perioral area, nor the surface quality of the skin. To complete facial rejuvenation in these areas, adjunctive procedures must be employed.

**Skin Resurfacing**

Dermabrasion can be performed by either diamond fraise or wire brush. It is most applicable in the perioral area, where the tissues can be stabilized and the dermis is thick. For correction of wrinkles, the depth of abrasion must be at least to the papillary dermis and often into the reticular dermis. The determination of depth with dermabrasion is diffuse bleeding in the fine papillary dermis and punctate bleeding points within course fibers of the reticular dermis.

The most common chemical peeling agents are trichloroacetic acid (TCA) and phenol. TCA, in concentrations of 15% to 42%, works very well for broad resurfacing of the forehead and cheeks.203 It is less effective in the perioral area. Phenol, used in conjunction with croton oil, is the most common peeling agent for the perioral area. Like TCA, phenol peels can be used in several concentrations.214-217 In all chemical peels, the amount of previous exfoliation of the epidermis and the amount of abrasion with application affect depth of penetration.218 The depth endpoints of these chemical peels are based upon degree of frost (keratin protein coagulation) and blanching of the skin vasculature. A white frost with pink showing through occurs at papillary dermal level. An opaque white frost indicates coagulation of the papillary dermal plexus, meaning that the peel has reached the reticular dermis.

The most common lasers for skin resurfacing are erbium:yttrium-aluminium-garnet (erbium:YAG) and carbon dioxide (CO2). Both use water as their target chromophore. When used as uniform resurfacing, the erbium:YAG laser behaves much like dermabrasion. Little heat is generated, so the treatment is mainly ablative. The CO2 laser has less affinity for water and therefore generates more heat. As a result, the effect is more coagulation than ablation. It appears that the presence of heat enhances the collagen remodeling, so that less depth is necessary.219

The historical problems with all uniform resurfacing methods were depigmentation and loss of skin appendages, causing a white, waxy appearance to the skin. In 2004, the concept of fractionated laser resurfacing was introduced.220 In this technique, microthermal zones of penetration were separated by untreated tissue. The premise was collagen stimulation with preserved surface quality. Both erbium:YAG221,222 and CO2 lasers223,224 have now been fractionated.

**Alloplastic Implants**

Alloplastic implants, primarily consisting of solid silicone, have been used to enhance the facial skeleton. The most common locations are the zygomatic body (cheek implants), mandibular symphysis or body, and inferior orbital rim.225 Alloplasts such as polytetrafluoroethylene (Gore-Tex; W. L. Gore and Associates, Newark, DE) have been used for permanent lip plumping, but alloplasts have been less well tolerated in mobile soft tissues.226

**Autogenous Tissue Grafting**

Trimming from the SMAS has been used as a subdermal graft in the nasolabial fold and in the lips.227 These grafts have been reported to have survival of up to 79% at 24 months.228 Fat aspiration and reinjection, as discussed earlier, is one of the most commonly employed methods of adding volume to the nasolabial and perioral areas. However, the survival of injected fat appears to be less successful in tissues with muscular movement, particularly the lips.

**Surgical Alteration of the Lips**

Not only do lips thin with age, but the upper lip lengthens and the commissures descend. Nostril sill excision was popularized in 1986 and has stood the test of time for correcting excessive vertical length of the central lip.229 Surgical correction for the corner of the lips at the commissures has been more problematic. The author’s initial approach was to extend a skin ellipse excision lateral to the corner, but a visible scar remained. A recent modification restricts the skin excision to just over the vermilion border.230

**Injectable Fillers**

The most commonly used intradermal fillers are hyaluronic acid products. These are hydrophilic substances used primarily in creases or to enhance lip volume. One advantage of hyaluronic acid products is that they can be reversed by the injection of hyaluronidase.231,232

**Botulinum Toxin**

Dynamic wrinkles caused by excessive mimetic muscle activity can be softened with the use of botulinum toxin. The most common type is botulinum toxin A. It is generally useful in the glabella (corrugator muscle), lateral orbit (orbicularis oculi), and forehead (frontalis).233-235 Botulinum toxin has also been advocated for weakening the depressor anguli oris muscle to diminish downturns at the corner of the mouth.236

**CONCLUSIONS**

A variety of surgical methods exist for improving the soft tissue contours of the aging face. Historically, the origi-
nal approach involved limited excisions only, but there are now several well-documented approaches and techniques available to us, including the high SMAS, short scar, and extended SMAS lifts, as well as the Tonnard and Verpaele extended MACS lift. Careful patient selection—including an assessment of the patient’s risk factors and expectations—and thorough preoperative preparation and postoperative care are essential.

DISCLOSURES

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