Liposuction

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Anatomy

The tissues of the face and neck are comprised of various layers including skin, subcutaneous fat that is highly compartmentalized into superficial and deep subunits, superficial fascia including the SMAS and platysma, deep fascia, facial mimetic muscles, and bone. The subcutaneous fat is contained in a fatty-fascial layer that covers the face and neck and thickens anteriorly in the midface to become the malar fat pad. Once originally thought to be a large confluent mass of fat, recent studies have shown that the fat of the face and neck is organized into distinct anatomic compartments (Table 26.1, Fig. 26.1). These compartments are separated by fascial septae that originate from the superficial cervical fascia and insert into the dermis. Perforating vessels travel through the septae to supply the skin in distinct angiosomes.

These fat compartments are thought to age differently causing noticeable contour differences through both volume and position changes (volume loss and ligament laxity/tissue descent). When performing liposuction, the surgeon may encounter areas that are easier to dissect and others with more resistance—the areas of resistance usually correspond to transition zones between compartments, which can be subject to injury to deeper tissues, including nerves. Therefore, it is very important to maintain the correct plane during the procedure.

Sensory Nerves

CN V (Trigeminal Nerve)

- V1 (*ophthalmic division*): supraorbital n., supratrochlear n., palpebral branch of lacrimal n., infratrochlear n., external nasal branch of anterior ethmoidal n.
- V2 (*maxillary division*): infraorbital n., zygomaticofacial n., zygomaticotemporal n.
- V3 (*mandibular division*): mental n., buccal n., auriculotemporal n.

Cervical plexus (C2–4)

- Greater occipital n. (C2).
- Lesser occipital n. (C2, 3).
- Great auricular n. (C2, 3).
- Transverse cervical n. (C2, 3).
- Supraclavicular n. (C3, 4).

Motor Nerves

CN VII (Facial Nerve)

Innervates the muscles of facial expression via five terminal motor branches: **temporal**, **zygomatic**, **buccal**, **marginal mandibular**, **cervical**. These branches are found at four different depths in the face and neck.

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Table 26.1 Fat compartments of the face. The layers of facial fat are organized into distinct compartments that contain important structures and constitute noteworthy surgical landmarks

Region	Superficial fat compartments	Notes
Forehead	Central, middle temporal, lateral temporal-cheek	Supratrochlear a. is the boundary between central and middle temporal; lateral temporal-cheek is the most lateral compartment and spans from forehead to neck
Orbital	Infraorbital fat (malar mound)	Superior margin is at lid/cheek junction. Above junction, little fat is present, below junction fat covers orbicularis oculi
Nasolabial	Nasolabial	Most medial; lower border of zygomaticus major m. adheres to compartment; angular a. perforators run in NL septum
Cheek	Medial, middle, lateral temporal-cheek	Facial v. found at deep surface of medial cheek fat; where medial and middle compartments meet is parotidomasseteric ligaments; lateral cheek septum is first transition zone in face lift
Cheek	Jowl fat compartment (superior/inferior)	Adherent to depressor anguli oris (DAO) medial boundary is lip depressor, inferior boundary is a membranous fusion with platysma (mandibular retaining ligament)
Region	Deep fat compartments	Notes
Cheek	Deep medial cheek	Deep to medial and middle superficial cheek fat; potential space between deep medial cheek fat and maxilla periosteum (Ristow's space) can be used for fat transfer, located medial to zygomatic major. Important for central cheek prominence. Inadequate volume results in anterior flattening
Cheek	Buccal	Lies adjacent to deep medial cheek fat in masticator space. Extends from edge of upper mandible into the temple affects the jowl prominence. Facial nerve and parotid duct travel through this compartment
Orbit	SOOF-medial and lateral compartment	Lies along orbital rim and zygomatic arch immediately above periosteum, medial compartment smaller than lateral. V2 travels through medial compartment, zygomaticofacial travels through lateral compartment. Lateral soof is important for cheek projection

Motor nerve function to the mimetic muscles of the first three layers is supplied through the deep surface of the muscle whereas the deepest layer of muscles, including the **buccinator**, **levator anguli oris**, **and mentalis**, receive their **innervation via the superficial surface** of the muscle (Table 26.2).

Vascular Supply

The blood supply to the face and neck is provided by the facial artery, which further branches into the superior/inferior labial and angular arteries, superficial temporal artery, transverse facial, submental, and posterior auricular arteries. Venous drainage is carried by the internal, external, and anterior jugular veins as well as the veins that run with their corresponding arteries.

Neck

Anterior compartment—bounded by the midline of the neck, the inferior border of the mandible, and the anterior border of the SCM.

Posterior compartment—bounded by the posterior border of the SCM, the anterior border of the trapezius, and the middle third of the clavicle.

Superficial cervical fascia is deep to the skin and envelopes the platysma muscle. The **deep cervical fascia** invests the neck structures and is divided into **three layers**: the **investing layer** surrounds the SCM and trapezius; the **visceral (pretracheal) layer** is limited to the anterior neck and surrounds the trachea, esophagus, infrahyoid strap muscles, and thyroid gland—posteriorly it is called the **buccopharyngeal fascia** and covers the buccinator and pharyngeal

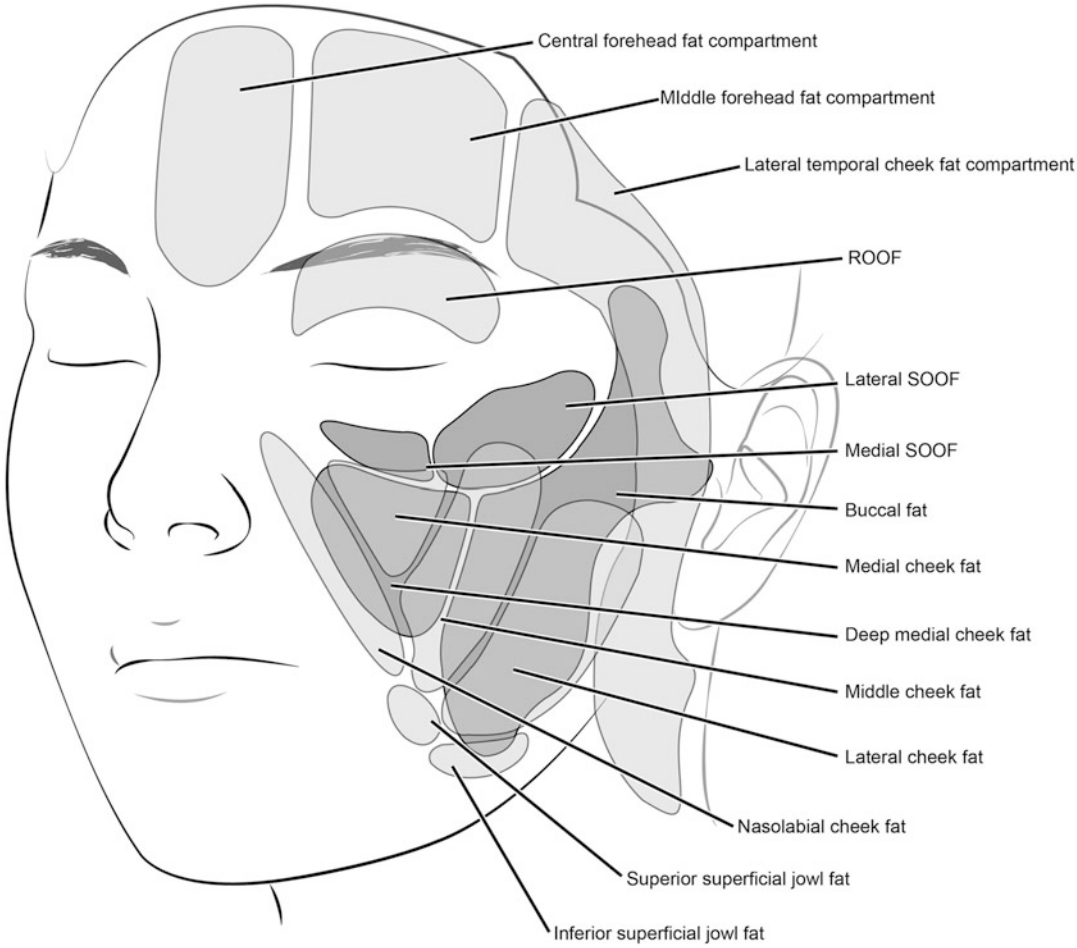

Fig. 26.1 Facial fat compartments. The fat of the face and neck is organized into distinct anatomic compartments. *Light gray* = superficial fat compartments, *dark gray* = deep fat compartments

constrictors; and the **prevertebral layer** invests the vertebral column and the prevertebral muscles—anteriorly it includes the **alar fascia**. The **carotid sheath** blends with all three layers to form a distinct layer over the IJ, common carotid, and vagus nerve.

Introduction to Liposuction

Physiology of Adipose Tissue

Adipose tissue is composed of adipocytes (with variable fat content) surrounded by a connective tissue matrix (collagen, elastin) along with macrophages, pericytes, fibroblasts, and mast cells. Fat in the fetus is thought to develop from fibroblasts and appears in month four of gestation. The number of fat cells triples during year one of life and increases again at puberty. Weight gain is initially through lipid accumulation and **adipocyte hypertrophy**. As weight gain continues, however, immature precursors form new fat cells—this **adipocyte hyperplasia** is thought to be permanent and resistant to future weight loss.

Fat deposits in the face and neck can be attributed to genetics, hormonal imbalance, poor diet, and lack of exercise. Facial fat compartments are isolated and as a result they do not respond to diet and exercise like other fat

Table 26.2 Mimetic muscles. The mimetic muscles are supplied by the facial nerve (CN VII) and are involved in facial movements and the expression of human emotions

Muscle layer	Mimetic muscles	Innervation
1 (Superficial)	Depressor anguli oris, zygomaticus minor, and orbicularis oculi	Deep surface of muscle
2	Depressor labii inferioris, risorius, platysma, zygomaticus major, and levator labii superioris alaeque nasi	Deep surface of muscle
3	Orbicularis oris and levator labii superioris	Deep surface of muscle
*4 (deep)	*Mentalis, levator anguli oris, and buccinator (MLB = mnemonic for these muscles)	*Superficial surface of muscle

* muscles that are innervated along their superficial surface

deposits in the body, and they are the first to hypertrophy with an increase in weight.

Lipolysis is a biochemical pathway that involves the breakdown of triacylglycerol (TAG) stored in adipocytes. Non-esterified fatty acids (FA) are produced from the hydrolytic cleavage of TAG, which are then used as energy substrates, precursors for lipid and membrane synthesis, or mediators of cell signaling. The process of lipolysis occurs in almost all tissues, but is most prevalent in white and brown fat.

Facial adiposity has complicated efforts at facial rejuvenation over the years. The goal of suction lipectomy is to create a more refreshed appearance and restore definition of natural facial angles through recontouring of fat deposits that are ptotic, malpositioned, and redundant. Since the number of fat cells in the adult is relatively stable the **goal of liposuction** is to **permanently remove facial/neck fat cells** by suction-assisted avulsion and facilitate **contraction of the subdermis** (including the subcutaneous tunnel network) during the healing process.

History

- 1970s: Schrudde discussed the idea of "lipoexeresis."
- Manipulation of fat was initially performed as an adjunct to rhytidectomy.
- Fischer, Fischer, and Kesselring described using a tube connected to a suction device to suction fat through small incisions.
- Illouz utilized the technique of lipolysis by injecting hypotonic saline and then using a blunt-tipped cannula to aspirate fat under high vacuum. His extensive studies showed fat cells multiply from birth to puberty and then stabilize in number—obese children have a large number of adipocytes (hyperplastic), whereas obese adults have large fat cells (hypertrophic) from FA and TG deposits increasing the overall volume.
- Many innovations in suction lipectomy of the face/neck have derived from body contouring research.

Benefits

- Minimal scarring.
- Shorter recovery.
- Decreased tissue/nerve trauma.
- Cosmetically favorable and hidden incisions.
- Neurovascular pedicles are preserved resulting in less bleeding and less hypoesthesia.
- Despite many advantages, deep midline fat is not adequately treated with liposuction and often requires direct excision.

Analysis

History

Liposuction has essentially replaced direct lipectomy techniques due to its safety and ease. It can be performed as an isolated procedure or in conjunction with other facial rejuvenation procedures. Optimal candidates have excess fat deposits on exam, which the surgeon and patient agree to address with surgery. As with any elective surgical procedure, it is critical that the

patient has realistic expectations of the anticipated outcome. The facial plastic surgeon needs to elicit information from the patient regarding their past medical history, past surgical history, medications, allergies, tobacco/alcohol use, history of easy bleeding, and problems with anesthesia. Specific questions regarding prior neck surgery, trauma, history of radiation, or history of collagen, vascular, or systemic diseases that would impede wound healing should be identified. Additionally, patients that are overweight and who have generalized fat deposition in multiple tissue layers are difficult to correct with liposuction alone and may benefit from a weight loss program. Failure to recognize these important considerations can lead to complications, poor results, and patient dissatisfaction.

Physical Exam

The ideal candidate for liposuction is a younger patient with good skin elasticity and muscle tone. As patients age, the ability of the skin to contour to the neck is diminished due to breakdown of elastic fibers and collagen and progressive muscle laxity.

Characteristics of a youthful, aesthetically pleasing neck: distinct border of inferior mandible with no jowl, visible thyroid cartilage, subhyoid depression, visible anterior border of SCM, and a cervicomental angle between 105 and 120°. Definition of the cervicomental angle can be affected by a low/anterior hyoid, retrusive chin, prominent digastrics, ptotic submandibular glands, and skin elasticity/tone. The surgeon must therefore carefully consider these when evaluating a patient for surgery.

The **Illouz test** can be used to assess the skin tone. The distance between the earlobe and menton is measured. It is then measured a second time after pulling the skin away from the face; if the difference is less than 15 % then suction lipectomy is likely all that is needed; if it is greater than 20 % then rhytidectomy may be indicated.

Table 26.3 Dedo classification of cervical abnormalities. The Dedo classification is used to assess the types of neck deformities as well as the best surgical techniques to address them

Dedo classification		
Class	Deformity	Proposed technique
1	Minimal deformity, well-defined cervicomental angle, no fat accumulation, good platysma tone, younger patient (<40)	N/A
2	Skin laxity, no fat accumulation, good platysma tone	Rhytidectomy
3	Fat accumulation	Suction-assisted lipectomy
4	Platysma banding	Platysmaplasty
5	Congenital/acquired retrognathia	Mentoplasty, genioplasty
6	Low hyoid	Difficult to optimize cervicomental angle

The Dedo classification system provides a useful reference for the surgeon to highlight certain physical exam findings as well as the aesthetic procedures that are commonly used to address them (Table 26.3).

The hyoid and chin position are critical to analyze as the underlying bony anatomy ultimately determines the appearance of the neck. The position of the hyoid is a critical factor in determining the cervicomental angle. A low hyoid position is difficult to correct and can lead to disappointing results. The **ideal chin projection** is defined as 3 mm posterior to the nose-lip-chin plane, which is the line extending from a point one-half the distance of the ideal nasal length through the upper and lower lip vermillion. Alternatively, it has been defined as one in which the anterior border of the chin closely approximates a vertical line from the vermillion border of the lower lip. Patients with retrognathia or microgenia may benefit from chin augmentation in addition to suction-assisted lipectomy for an optimal outcome.

The submandibular glands and anterior digastric muscles should also be inspected for their role in obscuring the cervicomental angle. Digastric prominence, submandibular gland ptosis, and/or hypertrophy should be distinguished from fat deposits as correction of these deformities is optimally achieved with reduction techniques through an anterior neck approach.

Patients with platysmal banding should be cautioned regarding liposuction. Removal of fat can exacerbate or unmask platysmal banding resulting in **cobra neck deformity** of the submental area. In this patient population, a platysmaplasty is often required to produce an improved neck contour.

Patients with good skin elasticity (leads to skin contraction, otherwise can have sagging) no platysmal banding, and localized fat deposits, e.g., palpable submental fat mass, stand to benefit the most from this procedure. Other characteristics that make a patient a good candidate for this procedure include lack of wrinkled/lax skin as well as no visible platysmal banding.

Photo Documentation

Standard facial photographs should be obtained preoperatively for documentation and to use for photo manipulation to demonstrate anticipated postoperative results. Photographic views should include anterior, lateral, oblique, and neck flexion. Additional photographs with the patient smiling and grimacing document the form and function of the platysma.

Patient Counseling

Skin irregularities and asymmetries should be noted and discussed with the patient preoperatively. The expected postoperative course should also be discussed with the patient including bruising and discoloration, which can last for 1–3 weeks, as well as edema and induration, which can last for months. Less commonly, patients can experience pigment changes related to hemosiderin deposits. Patients commonly wear a facial sling continuously for a week to help limit swelling and then intermittently for up to 4 weeks after surgery. Irregularities are usually transient and are treated conservatively with reassurance, gentle massage, and occasionally with steroid injections. Temporary numbness and tingling are also possible. Activity is usually restricted for 2–3 weeks to prevent additional swelling, decrease the chance of bleeding, and allow the soft-tissue envelope to adhere to the subcutaneous tissues. Results are unpredictable and vary by patient and may take up to 6 months to be evident.

Incisions, Approaches, Techniques

Incisions can be placed in the following areas: **submentum**, **infralobular crease**, **nasal vestibule**, **pretragal**, **postlobular**, **and temporal hairline**. Incisions must be made large enough (4–8 mm) to avoid friction burns and skin excoriation. It is important to use a carefully designed and evenly distributed tunnel system to avoid irregularities and bulges.

Facial regions typically treated with liposuction include submentum, lateral neck, jowls, and buccal region. Also may treat nasolabial folds and lower jowls, although results are less predictable. Treatment of the mid-face is risky because of the natural tendency for fat atrophy in this region. Areas of excess skin laxity and tissue descent are not good areas to treat with this procedure.

Equipment

- Cannulas: 1, 2, and 3 mm (most precise) up to 4 and 6 mm (used judiciously for larger fat deposits).
- Fat cells are sucked up through the perforated cannula and avulsed.
- High vacuum pressure can cause cell lysis directly.
- Low vacuum pressure is used if fat transfer is going to be performed to decrease trauma to adipocytes and increase the yield of viable cells (usually with Luer-Lock aspiration cannula).

- Negative pressure generated by electrical machines is 1 atm = 960 mmHg; handheld syringe is 700 mmHg initially, then drops to 600 mmHg.

Description of Procedure

Patient marked preoperatively for important landmarks (SCM, hyoid, angle of mandible) and areas to be treated while sitting down (tissue can become distorted when supine).

Approaches:

Closed is often used when suction lipectomy is performed as an isolated procedure.

Open is common when the procedure is performed along with a facelift and larger incisions are used (an electric vacuum must be used for the open technique because there is no seal present to allow for use of handheld syringes).

Tumescence of treatment area with hypotonic saline solution mixed with local anesthetic (causes hydrodissection and facilitates fat aspiration); additionally local anesthetic is used for nerve blocks along planned incisions and throughout the treatment area.

Incisions are made based on the areas to be treated and scissor dissection is carried out to establish the appropriate plane; the cannula is then used for pretunneling before attaching the vacuum to facilitate passage of the cannula during the procedure.

Perforated rigid blunt-tipped cannula (1, 2, and 3 mm—best control/precision) attached to a suction device inserted through skin incision and passed back and forth through fatty deposits through subcutaneous tunnels just deep to the dermal-subcutaneous interface; fenestra of the cannula is **pointed away from the dermis** to avoid injury.

Superficial tunnel is used by tenting skin away from deep tissues; the left hand is the "smart" hand and is used to guide the cannula, direct fat into the fenestra, and maintain the correct plane; the right hand is the "motor." Care is taken to avoid perforation of the platysma, which could put the patient at risk of injury to the underlying neurovascular structures and promote bleeding.

Treatment extends to SCM laterally and hyoid/sternum inferiorly in a radially directed fan-shaped pattern. Areas of greatest fat density can be treated with larger cannulas to aide in fat removal; more distant sites are treated more conservatively to help achieve a feathering/blending effect.

Care should be used when removing the cannula through incision site to avoid skin injury (simply pinching the suction tube temporarily will stop the vacuum to allow safe withdrawal and reinsertion).

Use of multidirectional crisscross approach generates extensive overlapping tunnel network that facilitates contour enhancement (Fig. 26.2). Avoidance of fat overexcision is accomplished by frequent checking of progress and the **pinch-and-roll technique**, which involves gently pinching the skin between thumb and forefinger and rolling it—a sufficient amount of fat is excised when a thin layer of fat is felt between the layers.

Extraction volumes vary per person, but usually require 10–100 cc.

Sometimes fat deep to the platysma needs to be excised to improve the cervicomental angle either using careful liposuction or direct excision.

At the conclusion of the procedure, the sites are irrigated and hemostasis is achieved, drains are usually not needed, but a compression dressing is used to help prevent edema/hematoma.

Complications

Transient irregularities are common and should be discussed with patients preoperatively. There is a less than 1 % chance of infection, hematomas, seromas, and sialoceles. Skin sagging and dermal scarring can result in longer lasting irregularities. Asymmetry may result from uneven aspiration from poor technique. Depressions can develop that require treatment with filler. Rarely patients may experience

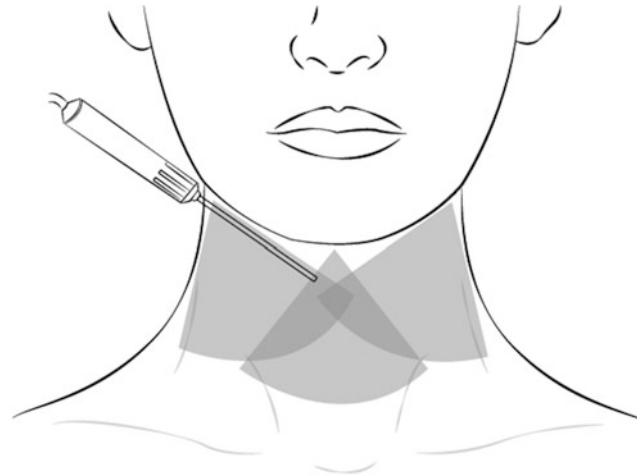

Fig. 26.2 Radial fan-shaped tunnels are used to perform suction-assisted lipectomy. Multiple access points and overlapping treatment areas help to blend and feather transition zones

weakness of the marginal mandibular branch of the facial nerve or hypoesthesia.

Bulges, asymmetries, and dimples that persist after 6 months can often be treated with additional suction lipectomy, fat injection, or subcutaneous steroid injection. Treatment that is too aggressive can result in hollowing, concavities, or unmasking of platysmal banding.

Autologous Fat Transfer

Since the introduction of liposuction, autologous transfer of harvested fat has been used for facial rejuvenation, traumatic deformities, lipodystrophy, hemifacial atrophy, rhytides, malar and chin augmentation, post-liposuction irregularities, etc. Knowledge of adipocyte physiology and optimal harvesting techniques has led to the use of cannulas no larger than 3 mm—common technique uses 3–10 cc syringe with 14-G needle or blunt micro-cannula for aspiration of fat. The harvested fat is then separated by allowing it to settle over time, by filtering it with gauze, or with light centrifugation. Minimizing trauma to the fat cells helps to improve yields. Extra fat can be frozen and used for up to 2 years. The recipient area is anesthetized with care not to distort the tissue. Fat is injected in a retrograde fashion from deep to superficial with a 1 ml syringe using a cannula or needle. It is done using minimal positive pressure with multiple passes to achieve a natural and smooth appearance. Usually injected into subcutaneous plane with slight overcorrection. After injection the area can be molded for further refinement and contouring. May require multiple treatments for optimal results.

Additional Considerations

When used alone suction lipectomy is most effective in creating *contour changes* in the cervicomental angle and jowl regions. Less predictable results are achieved when treating the nasolabial folds and lower jowl fat pads. Patients over 40 may not possess enough skin elasticity to allow for adequate contraction after liposuction alone; therefore, rhytidectomy may be necessary to achieve optimal results.

Suction lipectomy can also be used as an adjunctive procedure for further refinement along with chin implant, rhytidectomy, or platysmaplasty. For example, pretunneling followed by closed liposuction is done in the neck and lower face. After reduction of cervicofacial fat collections, undermining of facial flaps is facilitated by the atraumatic subcutaneous tunnels created from suction lipectomy,

which only requires division of the subcutaneous bands to complete the dissection. Once the flaps are raised, open liposuction may be carried out using a spatula-shaped cannula tip to further refine the lower face and neck.

New innovations in the field of liposuction of the face and neck include the introduction of smaller and varying types of cannulas, tumescence of the areas to be treated, use of ultrasound, and the liposhaver (actively excises fat instead of avulsion, less traumatic).

Questions

1. A 46-year-old female patient comes to your clinic for evaluation of prominent bands in her medial neck with horizontal rhytides. On exam, she has good skin elasticity with no appreciable skin excess and no lipodystrophy. What is the best management of her problem?
   (a) Giampapa suture-suspension neck lift.
   (b) Suction-assisted lipectomy with platysmaplasty.
   (c) Platysmaplasty.
   (d) Injection of bands with neurotoxin.
   Answer (d): Not all patients with cosmetic neck deformities warrant surgical intervention as some may be candidates for treatment using a neurotoxin. A classic example is a woman between 45 and 50 years old with platysmal banding, horizontal rhytides, and no lipodystrophy, excess skin, or submandibular gland ptosis.
2. Which of the following facial mimetic muscles receives facial nerve innervation from its deep surface?
   (a) Depressor anguli oris.
   (b) Mentalis.
   (c) Platysma.
   (d) Zygomaticus major.
   Answer (b): The three muscles that receive facial nerve innervation from the deep surface are mentalis, levator anguli oris, and buccinators (MLB).
3. Negative pressure levels generated by electric vacuums and handheld syringes used in suction-assisted lipectomy are?
   (a) 960 mmHg/700 mmHg.
   (b) 900 mmHg/660 mmHg.
   (c) 1.5 atm / 600 mmHg.
   (d) 1.0 atm/650 mmHg.
   Answer (a): The correct answer is (a). Of note, after the initial negative pressure of 700 mmHg is achieved with a handheld plunger, the pressure drops to 600 mmHg.
4. Techniques for harvesting autologous fat for transfer include all of the following EXCEPT?
   (a) Tissue filter.
   (b) Centrifuge.
   (c) Cell sorter.
   (d) Separation in syringe.
   Answer (c): The best methods are the ones that handle the cells as gently as possible. Less trauma to the fat cells translates to a higher yield for transfer.
5. A 58-year-old female patient comes to your office to consult with you regarding her concerns about the appearance of her neck. She has fat deposits in the submental and submandibular regions, skin laxity, and no obvious platysmal banding. What procedures would you recommend for her facial rejuvenation?
   (a) Rhytidectomy and liposuction.
   (b) Liposuction and platysmaplasty.
   (c) Rhytidectomy and platysmaplasty.
   (d) Rhytidectomy, liposuction, and platysmaplasty.
   Answer (d): The patient certainly needs liposuction to address her fat deposits and rhytidectomy for her lax skin. Platysmaplasty would also be recommended even if anterior platysmal banding is not evident clinically. Experience has shown that the combination of rhytidectomy and liposuction predisposes the patient to postoperative platysmal band deformity; therefore, addressing the medial edges of the platysma at the time of surgery is the most prudent option.