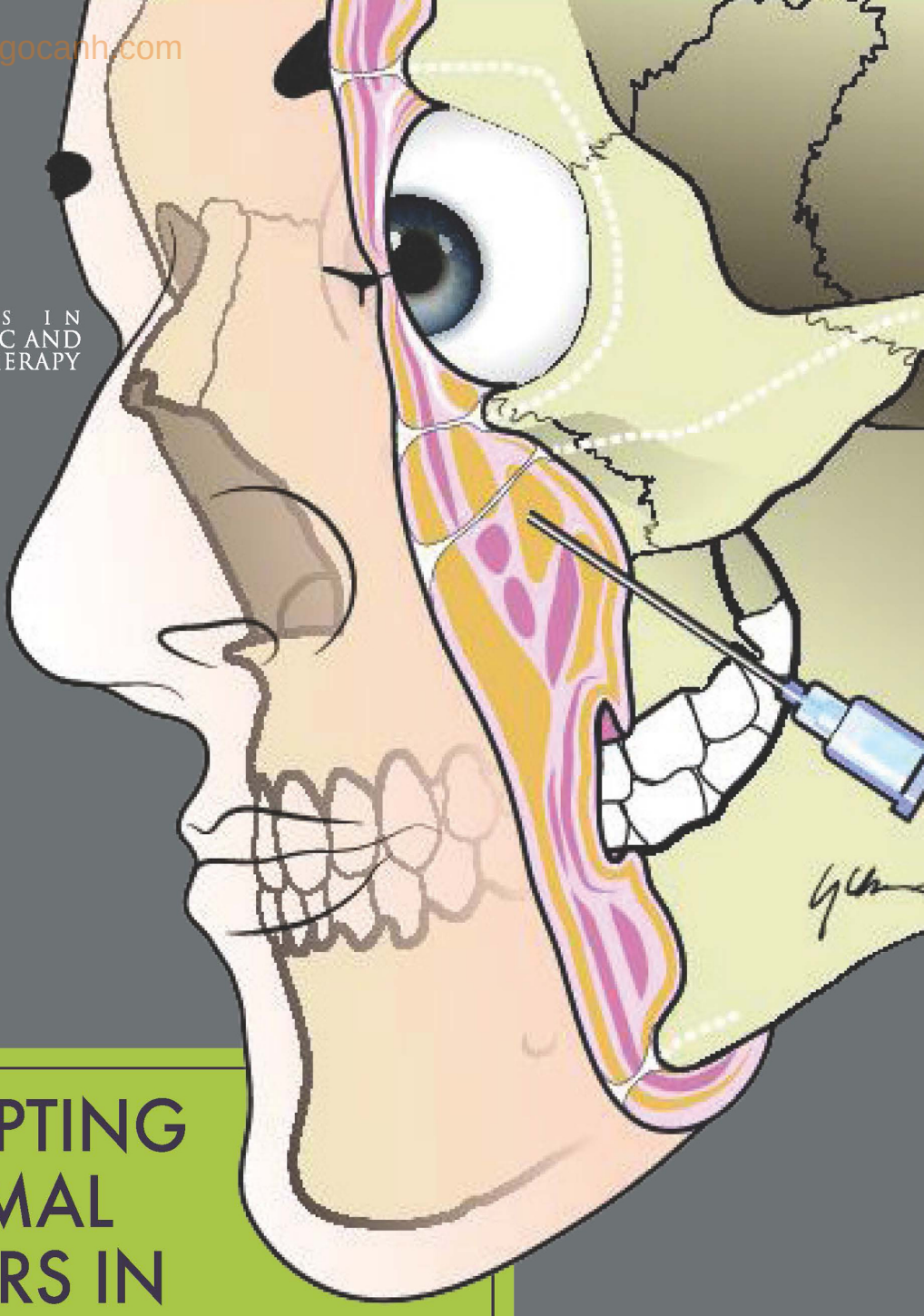

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EDITED BY
YATES YEN-YU CHAO
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Adapting Dermal Fillers in Clinical Practice

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Adapting Dermal Fillers in Clinical Practice

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Preface

Esthetic injectable procedures have become popular and a mainstay of treatments to improve the outward appearance of face and body during the last two decades. According to various statistics, neuromodulator injection is usually ranked as the number one procedure, with injectable hyaluronic acid filler as number two. However, if you include all the other choices of filler apart from injectable hyaluronic acid – and consider the point that the shorter duration of effect with botulinum toxin (only four to six months) means any one patient usually requires at least twice as many toxin injections for the same treatment – injectable filler enhancement is actually the number one procedure in terms of patients treated.

The reason patients nowadays prefer needles to scalpels is the common belief that injectable filler treatments are convenient, quick, easy, safe, moderate in price, with limited downtime, minimal tissue destruction, temporary and reversible, and will not result in a big change as surgeries. However, it might not be as rosy a picture as you think when an inappropriate filler is delivered in the wrong layer by suboptimal technique, using incorrect concepts, with unrealistic expectations, and without comprehensive knowledge of substance rheology and underlying tissue structures, correct assessment, and good design. Some patients are currently persuaded to have an unreasonably large amount of fillers, with worrisome procedure combinations at huge cost. Some fillers are not temporary, and some techniques are quite traumatic; unfortunate stories from injection occasionally happen. The techniques and theories for administering injectable fillers keep on evolving, and many formerly state-of-the-art techniques and common beliefs are no longer regarded as standard as more evidence-based understanding in anatomy and materials has been revealed.

The anatomy of the face is highly complex. It allows for meticulous movement, for the display of a large set of emotions, is essential in social interaction and communication, and marks the beginning of the digestive tract. Facial anatomy and knowledge of the pathomechanisms involved in facial aging should lay the groundwork for every injector aiming at rejuvenating the face, enhancing esthetic facial features, or reconstructing form and function after injury or disease. Analysis of the underlying anatomy of an individual's face is key prior to any treatment, and luckily our understanding of facial anatomy has profoundly increased over time allowing for safe, effective, and efficient injections. In the past decade, we have gained immense insight into the anatomy of the face, by using cadaver dissection, computed tomography, dynamic ultrasound assessments, and three-dimensional surface imaging. It is in the best interest of our patients to provide a large professional audience with anatomical education and to accustom it to the complexity of the different facial soft tissue layers, not in order to discourage it from performing treatments, but to increase respect, decrease carelessness prior to injecting, and at the same time increase efficiency and effectiveness of our treatments.

The whole project of injection-related esthetic enhancement should not be understood purely as science but as an art. In this book, dual cores of regional applied anatomy and clinical guidance are presented for intercorrelated in-depth explanation and demonstration. This book aims to provide practical techniques for different situations. Hopefully, it will be both a good companion during your journey of practice in esthetic medicine and a quick manual when facing different challenges.

Bon voyage!
Yates Yen-Yu Chao
Sebastian Cotofona

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1 Fundamentals of Injectable Filler Procedures

Yates Yen-Yu Chao, Sebastian Cotofana, and Nicholas Moellhoff

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1.1 INTRODUCTION

The practice of aesthetic medicine has experienced dramatic changes in the way we deliver our service. In a digitalized world, patients can easily research their problems and possible solutions, evaluate their budget, imagine the treatment outcome, and invest in the appropriate quantity and types of products they want. Doctors usually then plan and combine products according to the individual characteristics of each product and the clinical indications of different patients.

Minimally invasive cosmetic procedures have become mainstream. Among them, injectable soft tissue fillers are prepackaged products with different characteristics indicated for different purposes in a certain quantity. These handy packs of a product are ready for use, can be delivered quickly, and mostly give immediately visible effects (**Figure 1.1**). Any error occurring during the process of delivery can result in severe consequences, which is why these materials are strictly regulated in most countries and should be administrated by registered medical professionals, but even the safe placement of soft tissue fillers in tissue does not guarantee satisfactory aesthetic results.

The professional use of injectable fillers is not entirely medicine or even science. Every procedure for correction or enhancement using fillers should be performed or regarded as a form of art. Three-dimensional (3D) morphology, structural diagnosis, knowledge of anatomy, filler property, rheology, injection techniques, skills and soft tissue biomechanics, filler biology, immunology, and a sense of art or beauty are all important ingredients for a successful result.

This book will focus on injection techniques with only a succinct description of related subjects necessary for completing a safe and successful injection job; this chapter concentrates on the important physicochemical parameters involved.

1.2 PREPARATION OF FILLERS

Although most filler materials are prepacked as commercial kits with pre-paired needles or cannula, it is suggested some filling materials be kept under certain conditions that need to be prepared before they are applied to patients. Some of the fillers can be modified before injection to have varied physicochemical properties adapted to different purposes.

FIGURE 1.1 Some of the commercially available injectable fillers. One manufacturing technology usually can be varied in concentration, degree of modification, particle size, and physical differences, within several subtypes in a single range.

1.2.1 Temperature

Most hyaluronic acid (HA) fillers are suggested to be stored under 25°C and not recommended to be frozen. In some regions with warmer climates, HA fillers are sometimes recommended to be stored in fridges to maintain their condition. However, an HA-based soft tissue filler – a substance with non-Newtonian fluid behavior – will have higher viscosity at low temperatures. Treatment should only be started when the content within syringes has been raised to room temperature. Sudden loosening of the needle, or (especially) the Luer-lock adaptor, with leaking or a burst of HA material can occur when the plunger forcefully pushes a body of cold HA material.

Calcium hydroxylapatite (CaHA) and polycaprolactone (PCL) are suggested to be stored at room temperature. Some practitioners reserve some filling substances (part of a complete kit) for a future touch-up or repack one syringe of filler for different patients; however, the rest of the half-used filler is no longer aseptic. Even storing in a fridge under low temperature is not safe, as a temperature of 4°C cannot kill or inhibit microflora after possible contamination during the repackaging process.

Poly-L-lactic acid (PLLA) suspension needs injectable sterile water for the reconstitution 2 days before injection, according to the product instruction. Some consensus guidelines suggest storage below 4°C but without specifying reasons. The fact is that fridge storage does not tackle the concern about product sterility after exposure to the water to be injected. Many of the reported hypersensitive reactions are cases of delayed biofilm reaction. The key to ensuring injection material safety is to be strict at every step during reconstitution to keep the injectable suspension clean.

1.2.2 Dilution and Additives

With advances in soft tissue filler technology, more and more filler products come in a different formula with lidocaine already added in. Most studies on physicochemical properties and clinical efficacy or longevity show not much difference between the original version of a product and the one with integral lidocaine. Before the launch of local anesthetics containing filler products, a trace of lidocaine was frequently added to products of fillers to reduce pain during injection. However, the liquid form of most commercially available lidocaine when added into prepacked syringes of fillers can change the physical properties of the filler substance, including its elasticity, viscosity, and lifting capacity.

HA fillers that are extremely hydrophilic are especially vulnerable to changes in character upon dilution with aqueous lidocaine. CaHA, when mixed with lidocaine in even a minimal amount, will be lower in viscosity rather than in elasticity (**Figure 1.2**). The preserved elasticity can be beneficial for contouring with a retained ability to lift tissue and give structural support, while the lowered viscosity facilitates filler spreading and enables the injectors to mold the tissue after injection more easily. Mixing with lidocaine has been approved by the US Food and Drug Administration (FDA) for relieving pain during procedures and has been modified for verified indications for biostimulation or soft tissue recontouring to achieve more satisfactory results. Now there are also lidocaine-containing CaHA products with similar physical properties as the original formulation. When lower viscosity is desired for certain purposes in these cases, the CaHA with integral lidocaine has to be diluted again and normal saline would be preferable to lidocaine or sterile injectable water.

Though often compared with CaHA because of similar ingredients and the percentage of sodium carboxymethyl cellulose (CMC) gel contained, PCL microspheres behave slightly differently when mixing with lidocaine. The injection of pure form PCL is painful, and minimal doses of lidocaine mixing are the usual practice for injecting PCL, although this is not evidence-based. Hyperdilution with lidocaine is not suggested for PCL, as that practice usually changes the structure and behavior of PCL gel too much and would interfere with its contouring function.

FIGURE 1.2 CaHA is approved by the US FDA for dilution with injectable lidocaine, in addition to the lidocaine-containing CaHA that is now available on the market. The CaHA injectable product is diluted and hyperdiluted with lidocaine or normal saline by the injectors via a two-way or three-way connector to allow different functions of contouring and biostimulation.

The reconstitution of PLLA with sterile water and lidocaine immediately before an injection is often misunderstood as the process dissolving PLLA particles (**Figure 1.3**). PLLA is grossly water-insoluble. Reconstitution and standing for 2–48 hours before the injection is intended to break down the aggregates of PLLA flakes. CMC inside each vial of PLLA helps to suspend the insoluble PLLA particles. However, the present usual practice of adding 5–6 ml water exceeds the suspension capacity of the formulated CMC but can temporarily prevent the concentrated substance from aggregating together after remixing

FIGURE 1.3 Injectable PLLA has to be reconstituted with injectable water for several days and with lidocaine immediately before injection. Inverting the preparation with lidocaine can decrease the amount and degree of bobble formation that would otherwise interfere with the injecting process.

FIGURE 1.4 The CMC content inside each vial of injectable PLLA suspends the insoluble PLLA particles only temporarily, and the solution precipitates minutes after remixing by agitation. The vial on the left with lidocaine added precipitates quicker than the one with only water (on the right).

and thereby reduce the risks of nodule formation. There is a trend in some areas to add more water (9–12 ml), expecting a thinner solution and less nodule formation. However, the reasons for PLLA injection nodule formation have complex mechanisms but are rarely related to the concentration of suspended PLLA particles, in the senior author's experience. These very diluted PLLA solutions can precipitate very quickly and result in injection with the suspension of very different compositions if the procedure has not proceeded quickly enough and each syringe is not completed soon or vortexed immediately before administration (**Figures 1.4** and **1.5**). The suspension inside PLLA vials gathers as sediment soon after remixing when being extra-diluted. The extracted suspension can be thinner in the initial syringes and thicker in the later ones. The same scenario can happen even in the delivery process of the solution when the injection is not done quickly enough. Many experts feel PLLA suspension performs best when being injected via 25- to 26-gauge needles and after standing for 2 to 7 days.

Studies on the preparation of PLLA suspension in ways different from the traditional hours of standing have shown promising results. However, the manufacturer of injectable PLLA has proved that rigorous agitation 10–20 times immediately after reconstitution can break the aggregates as well as does long standing. The addition of lidocaine changes the environment of reconstituted PLLA and results in quicker precipitation of PLLA particles (**Figure 1.4**). Every treatment with injectable PLLA should be well prepared with remixing and should proceed quickly.

1.2.3 Repackaging

Repackaging sounds unprofessional but is often heard to be the practice of injectors. That certainly raises some worries about product hygiene and procedure safety. The purpose behind repackaging is usually to lower the treatment starting price to make it more affordable or to reserve something that could be used for touch-up in case some imperfection occurs or be used as an extra service when patients return. However, repacking the product breaks the barrier of the filler substance integrity and exposes it to the environment. Although reports of overt clinical signs of infection

FIGURE 1.5 Extracted PLLA solution separates quickly in syringes. That can occur quickly if the reconstitution involves too much water. Sedimentation of the solution can result in clogging of needles and asymmetric and unpredictable effects.

relating to repackaging are still scarce, contaminated bacteria could be the reason for subclinical biofilm formation. And should an incident happen, repackaging would certainly be open to criticism as misconduct.

The senior author has observed some practices of repackaging injectable filler substances into smaller insulin syringes to change the pressure ratio between the plunger and the needle. However, this kind of repacking maneuver needs the removal of the insulin syringe plunger, open filling, and reattachment of the plunger, leaving the whole kits even more exposed to possible contamination than does the disposable Luer-lock connector.

1.2.4 Needles and Cannula

For the purpose of aesthetic filler injection, the contents of the filler product are delivered to tissue in desired points at targeted depth by injection instruments. While the traditional injection using a sharp needles is sometimes challenged by recent studies on cadavers, clinical practitioners should carefully assess the impacts of target tissue and injecting environments, and interpret those results, while avoiding overgeneralization. Independent of the purposes and regions of injection, one procedure usually can be performed either by needles or by cannulas, but through different techniques and achieving its quality or effect differently. Cannulas are often thought to be safer, whereas needles are regarded as more precise. This dichotomous classification should be avoided; safety and advantages are the result of the right choice and proper utilization. Independent of the injector selected, safety should be the first priority. For the best practice and optimum results, both needles and cannulas should be considered and employed in the right ways in appropriate circumstances.

Cannulas possess a blunt, rounded tip with the opening for product delivery placed on the side. In theory, this design may reduce perforation and penetration of sensitive nerves and vessels while injecting, as the blunt tip glides around the neurovascular structures and requires higher pressure to penetrate these. Hence, they are often referred to as “atraumatic” injection devices. However, this holds true only for cannulas of a certain diameter. As the diameter decreases (i.e., 27-gauge cannula), the pressure required for penetration decreases and the device behaves similarly to a needle. Needles,

on the other hand, are generally considered traumatic, as they are sharp and the opening for product delivery is placed at the distal cutting edge, increasing rates of hematoma, swelling, and penetration of the arterial wall.

Precision of filler application in terms of horizontal and vertical product placement is affected by the type of injection device used. Filler implanted using a cannula is likely to remain in the plane of injection (i.e., supraperiosteal) and shows no change of plane within the facial layered arrangement, while injection using a needle can result in product distribution into more superficial layers due to retrograde backflow through the injection canal. The reason behind this might be the nature of the sharp needle tip that penetrates across layers, while the blunt tip of a cannula transverses more within a layer after the initial entry hole. When injecting with contact to the bone, a perpendicular injection angle and large needle size (25 G) causes most product distribution retrogradely along the injection canal, when compared to 45° and 10° injection angles. Irrespective of its applicability in clinical practice, injection using a 30-G needle, with a 10° injection angle in a bevel-down position, causes least product migration. When investigating the product spread within fascial layers using the bolus technique with a sharp needle and constant bone contact, data show an inverse relationship between storage modulus G′ and product spread. In other words, more fluid (and less viscous) products with a low G′ distribute into more superficial fascial layers, when compared with products that are less fluid and more viscous, irrespective of injected location. In clinical practice, if supraperiosteal injections are performed (e.g., to volumize deep midfacial fat compartments), the G′ of the product should be high to avoid product migration out of the targeted plane. A product's rheologic properties thus need to be incorporated within the treatment plan.

In addition, needle size and injection angle influence the product spread. Electron microscopy imaging revealed the incidence of needle tip deformation after repeated aesthetic filler injections in different tissue planes. With repeated injection, there is an increase in needle tip deformation up to 5% and contact with the bone can cause deformation of up to 10% per pass. This must be kept in mind, since multiple injections using the same needle are common practice but may cause an increase of pain as well as a decrease of precision.

For related comparison and suggestions please refer to each chapter (**Figure 1.6**).

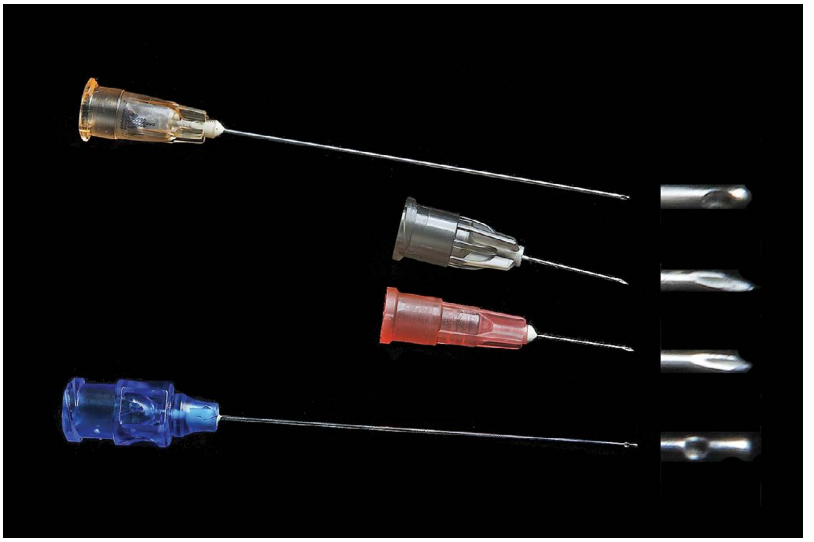

FIGURE 1.6 Cannulas have their opening at the side. The longer path of the cannula and the turning of flow direction increases resistance of the flow for deformable products like HA. However, the wider outlet of the cannula decreases the resistance of flow for liquid products like PLLA.

1.3 PREPARATION OF PATIENTS

Aesthetic treatments are not treatments for disease. There is no endpoint for improvement and what is considered as better looking is very subjective. So, the consultation is an extremely important part of the whole treatment process. Doctors have to realize what bothers the patient most and the priority among multiple problems (**Figure 1.7**). Patients often know their facial shape and contour from the mirror, selfies, and photographs and have more interest in certain problems under strong influence from social media. Some patients might have been treated previously or had their opinions influenced by others or previous practitioners. Doctors have to evaluate the patient carefully from different angles, not only by the impression in one particular environment (**Figure 1.8a** and **b**). The effects of posture have been described for facial soft tissue. For instance, 3D imaging reveals a decrease of soft tissue around the nasolabial fold, in addition to extrusion of the cheeks lateral and inferior to the eye, when patients are assessed in the supine as compared to an upright position. Studies also revealed that these gravitational effects are stronger in the elderly. Importantly, these effects must be taken into account during patient assessment in order to accurately determine the area to be injected and the amount of product required to achieve the most aesthetically pleasing result. Palpation of tissue and observation of muscle excursion all provide valuable information about underlying structures and clues pointing to the exact problem (**Figure 1.9**). The details of assessment for patients are beyond the scope of this book.

Patients should be well documented by photography in different angles – both static and expressing emotions – along with the history of previous treatments, previously used products, brands, types, amount, treatment time, combined procedures, treating doctors, and any reactions that occurred after the treatments.

Injectors should be very careful about giving another filler in an area where patients still have suboptimal results, especially when patients have disputes with the previous treatment giver. Injecting the area

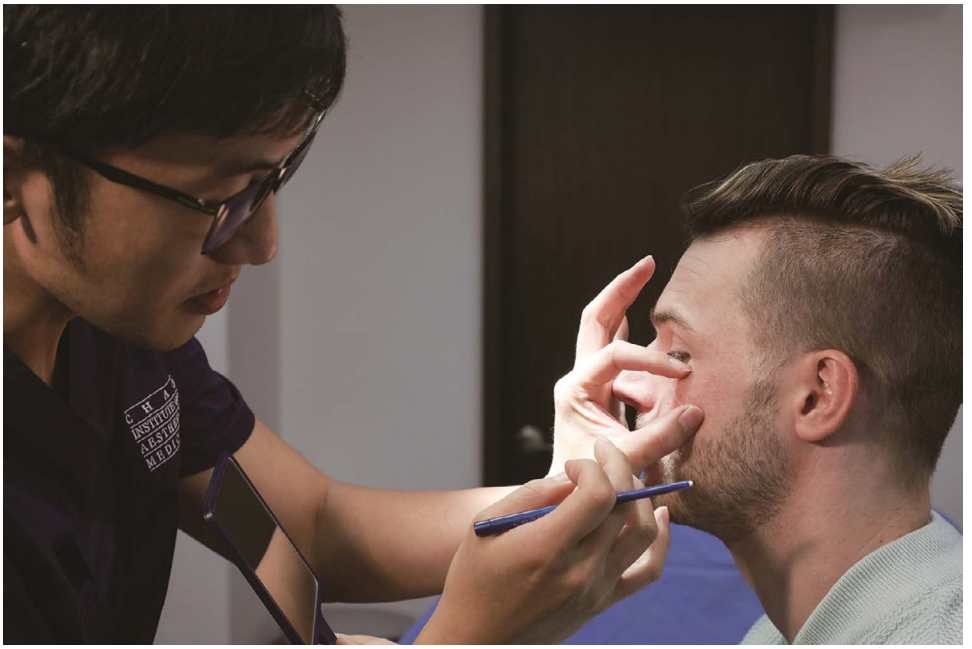

FIGURE 1.7 Consultation is an important process for doctors and patients to understand one another and understand where the real problems are located.

FIGURE 1.8 The pattern of illumination has great impact on the presentation of morphological problems. The light has to reveal the problems enough for the injectors and the patients and ideally facilitate the judgment and injection process. Light from above (b) contrasts the concave curves, including the malar grooves, the asymmetric severity and pattern of forehead, infraorbital contours and cheek grooves, which are not all discernable under light from the front (a).

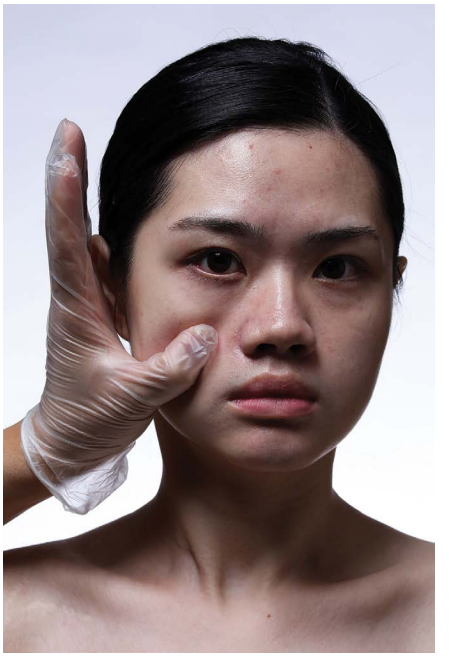

FIGURE 1.9 The injector has to know exactly the thickness and underlying structures of the contour by real palpation, not merely by visual observation.

where permanent fillers have been laid is not recommended. An immune reaction can be aroused with new substances and tissue trauma. Any injection can introduce some microflora during the procedure and complicate the situation further with biofilm formation. Different fillers come with different longevity; different materials face different tissue reaction. The senior author avoids mixing different types of filling substances together in one area, especially in one layer, although the mixing of different fillers together is thought to be very common. No evidence supports the practice of filler mixing with regard to the immune and biophysical stability of introducing two unrelated substances together in tissue. The injection of premixed fillers in one syringe at least will distribute them together in the same pattern. However, injecting different fillers in one area one after another can raise more concerns about filler distribution, in addition to safety and tissue reaction. Uneven placement of the first filler that is refilled or camouflaged with the second filler can result in complicated long-term problems of asynchronous longevity between substances of different longevity and different consistency.

Patients should be educated about the correct structural diagnosis rather than just the morphological interpretation, and the correct priority should be discussed. Treatments should be directed to what is agreed between the patient and the doctor. Clinical effects – such as PLLA, with its progressive improvements and possible reactions of swelling, redness, bruising, and pain – as well as the length of time that may be needed for them to go away, all need to be clearly explained to patients. Both proper management of expectations and good results of correction are important keys to satisfaction.

1.3.1 Cleansing

Filler injection is usually considered a minimally invasive procedure. The standard of preparation for treatment areas, disinfection, and handling of treatment instruments are sometimes not as strict as for surgical procedures. Surgery usually exposes and intervenes deeply into tissues but rarely leaves any substance inside after the suture is removed, but injection leaves foreign substances that could be there for more than a few years. Disinfection procedures should not be done randomly. The treatment area should be thoroughly cleansed and all makeup removed completely with cleansers. Topical anesthetics should not be left on the skin or only partially removed before injection, as injections could take them through the skin. Many injectors mark out the necessary areas with marking pens for the upcoming injections. However, these pens are certainly not sterile and the debris could contaminate the needle when injections are performed that directly pierce the marks or where the marks have been rubbed and soiled the whole injection field (**Figure 1.10**).

Injectors' gloves are another source of contamination. As injections are considered minimally invasive procedures, patients are usually not prepared with the injection field isolated from the other areas. Injectors who keep touching patients and the injection points during injection or adjusting lights could cross-contaminate the injecting skin. Molding the injected areas with a gloved hand can infect the area, even if it has previously been disinfected. Any further injection on this field should repeat the disinfection procedures. Studies showed alcohol, chlorhexidine, and povidone-iodine to reduce the biofilm bacterial, without differences between wipes.

1.3.2 Pain Control

Pain is an unpleasant experience that occurs during tissue injury and should be well controlled for both a smoother course of treatment and a better memory of the treatment. Hopefully, with every attempt being taken to reduce the pain of injection, the discomfort that occurred during procedures would not stop patients from pursuing further aesthetic advances. However, pain is also an important sign to warn doctors about possible upcoming dangers. Usually, for sharp needles, topical anesthetics can alleviate the injection pain, as the pain of filler injection partially comes from the needle breaking the skin. However, part of the pain is also from the needle/cannula dissecting tissue

FIGURE 1.10 Preinjection marking labels the extent and shape of problems and treatment planned and helps injectors to locate the structure when patients lying down.

and from the dissecting expansion of the filling materials in the tissue. Both these deeper types of pain are not well controlled by topical anesthetics. Fillers with higher elasticity and larger particles when expanding in the tissue result in more pain. The newer formula with lidocaine inside has already relieved much of the pain caused during filler tissue dissection. The sensitivity of a structure often reflects the importance of the tissue or its fragility; for example, compare the pain of needle insertion when it approaches a vessel or a piece of adipose tissue. That is why the signals of pain should not be blocked or masked by local infiltration or a nerve block. Filler injection under IV sedation or general anesthesia is believed to be more dangerous as it is done without access to the patient's responses. Good correction of tissue volume or facial curve should be a dynamic process adapting to muscle movements; deep sedation thwarts this interaction. Nerve block can also block the motor nerves, and infiltration of local anesthetics can result in temporary tissue distortion, morphological asymmetry, and abnormal dynamicity.

The entry holes of the injecting cannula could be infiltrated with a minimal amount of local anesthetic or prepared by topical anesthetics. Repeated in and out movements of the cannula without adequate preparation could be uncomfortable for patients.

1.3.3 Marking

Contour problems are easily visible in daily life when patients are mostly upright in social circumstances. However, our treatment settings seldom have patients sit or stand upright for injection procedures. Injectable fillers are products designed mainly to be filled in the soft tissue of the face; the live soft tissues are soft and weight dependent and can change in distribution and shape when patients are lying down or leaning on the table or in a chair. Marking the potential areas to be filled is important to locate the

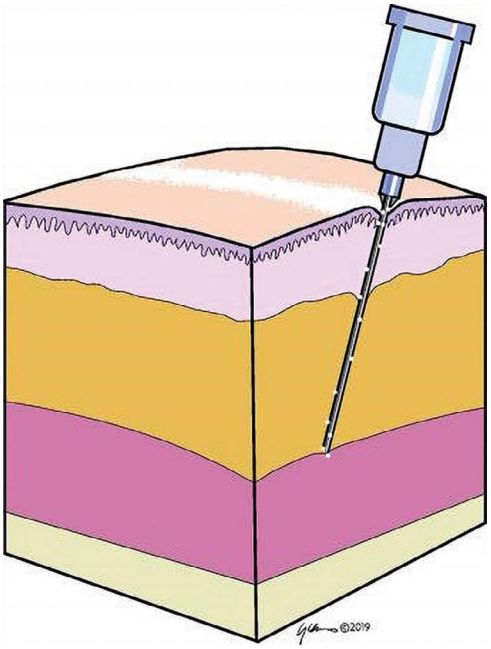

FIGURE 1.11 Insertion of the needle directly on the marking brings the marking substance into tissues and contaminates the needle and filler products.

real problem, even when the posture changes (**Figure 1.10**). Marking out the areas intended for different fillers and different amounts or the prohibited areas is important, too. As noted above, for the concern of treatment safety, the marking for injection procedures could be a source of contamination. However, total removal of this labeling before the exact injections is not practical as well. Injectors should avoid inserting needles directly upon these marks (**Figure 1.11**).

1.3.4 Positioning

The posture of the patients has an impact on how easily the injectors can access the patient and how correctly they can evaluate problems in every step during the injection procedure. Lying flat is not recommended because sagginess and grooves can disappear when gravity pulls the tissue to both sides instead of downward. An adjustable table with different leaning angles is ideal for injection treatments (**Figure 1.12a–c**).

1.4 DURING THE PROCEDURE

1.4.1 Illumination

Lighting is a great tool helping the injector to differentiate minor problems and minimal changes in contour. It also helps to judge the existence of any asymmetry or imbalance. Directional light sources are recommended and should be positioned in the midline with the correct direction calibrated. Good illumination can prevent inadvertent insertion of needles on visible arteries or veins and make the injector aware of subdermal bleeding at the earliest moment.

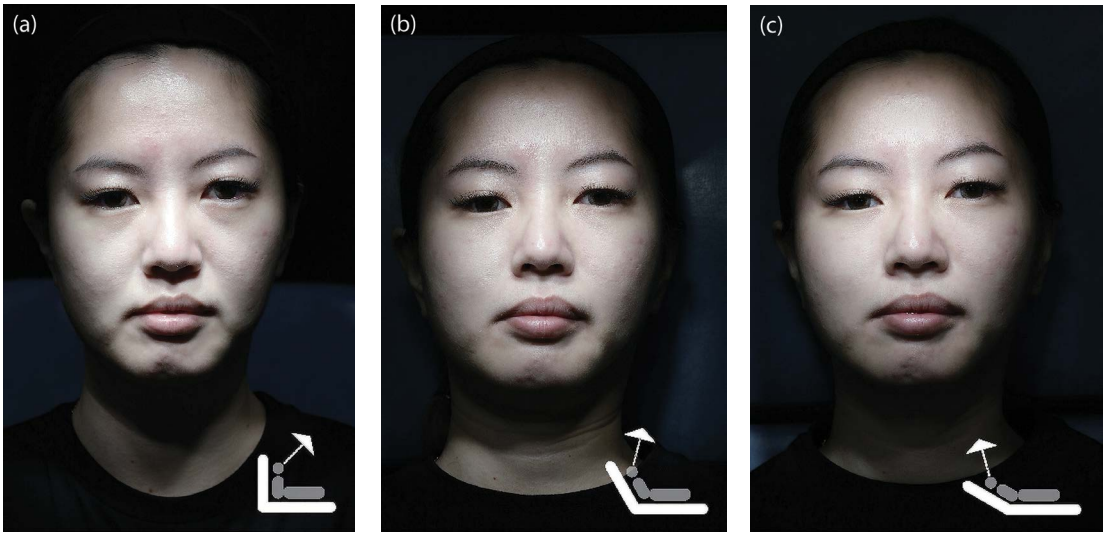

FIGURE 1.12 Most of the problems of concern result from contours that are visible in the upright position when tissue drags under gravity. Illuminations have been kept at 45° above the facial projection axis when the young patient sits upright (a), tilts 30° (b), and 60° (c), but the infraorbital shades, temporal depressions, lower face grooves, and cheek contours present very differently. That emphasizes that all the evaluation should be done at upright position, and marking should be done precisely then if the patient is to be injected while in other postures.

1.4.2 Antiseptics

With adequate cleansing of the skin, the treatment area should be prepared again with disinfectants. Because the injection of fillers is mostly a procedure of the face and is envisaged as a quick minimally invasive procedure, iodophor or polyvidone-iodine is not a good choice because it discolors patients' faces and its benefit of broad coverage against fungi, viruses, protozoa, cysts, and spores is not necessary for the usual clean facial skin intended for aesthetic injections. Chlorhexidine is a wide-spectrum bactericidal effective against Gram-positive and Gram-negative bacteria but less effective against some species of *Pseudomonas* and *Proteus* and relatively inactive against mycobacteria and bacterial spores. An amount of 0.5% solution in alcohol (70%) is indicated for pre-procedure skin preparation. An amount of 70% isopropyl alcohol or ethanol is representative disinfectants, but irritation occurs sometimes.

1.4.3 Bleeding Control

Drug history should be checked carefully during the consultation because drugs that increase bleeding tendencies will increase the rate or extent of bruising. These drugs include anticoagulants, antiplatelet, nonsteroidal anti-inflammatory drugs (NSAIDs), and novel oral anticoagulants (NOAs). Antidepression medications such as selective serotonin reuptake inhibitors (SSRIs) and selective norepinephrine reuptake inhibitors (SNRIs) are reported to inhibit the reuptake of serotonin into platelets, resulting in an increased risk of bleeding. Some natural supplements can have impacts on platelet function as well increasing bleeding tendency. These agents include chondroitin, coenzyme Q10, fish oil, ginkgo, garlic, green tea extracts, and vitamin E.

Ambient light and careful examination of vascular structures underneath the skin should help avoid injecting instruments hitting these vessels directly.

There are near-infrared imaging systems for the detection of veins under the skin with a real-time image of the subcutaneous vasculature up to a depth of 10 mm. Hemoglobin in the blood vessel absorbs the infrared light and there is reduced light reflection from the veins. However, the image could be full of distracting signals in complex areas like the forehead.

Tips for the injection technique when using sharp needles or cannula to reduce the risks of bleeding will be detailed in each chapter. Bleeding resumes when the tamponade of a needle or a cannula is released but clotting is not yet complete. Immediate compression of the needle or cannula entry hole stops only the blood emerging out of the skin. A moderate and evenly distributed force covering the whole injected area without deforming the augmented contour can lessen the extent and severity of upcoming ecchymosis and subdermal hematoma formation.

Patients who have taken medication before the procedure that impedes blood clotting function or those with bleeding tendency can have delayed bleeding out of needle holes several seconds to minutes after the finish of each instrument passage. Pressure should be applied in time and for long enough to decrease bruises and consequent local swelling.

1.4.4 Assistants

Having great assistants during procedures is a blessing; however, an assistant can also be the reason for errors. Assistants should be well trained with the concepts of antiseptics and clean procedures before, during, and after the treatment. Pressure applied by the assistant to help stop bleeding should not deform or dislocate the newly filled unstable volume.

1.5 AFTERCARE

Care after injection until recovery, when all the final shaping is settled, has to be considered a part of the whole experience of this treatment. For some injectable fillers, volume effects depend on the tissue reaction and that starts just after the filler placement is finished. It is as important as the injection process itself.

1.5.1 Pain Control

Inflammation due to needle/cannula trauma, hemorrhage, and a foreign body in tissue all result in pain. The wounds of instrument penetration – especially the entry holes of the cannula – will cause mild burning pain for hours or 1 to 2 days. The pain of the postinjection period should be mild and usually tolerable. Analgesics are not necessary. Pain is also a valuable sign in different situations. If pain keeps progressing or is prolonged, patients should be alerted to come back for a check-up. Herpes reactivation, infection, hematoma, supraperiosteal grouping nodules, or nerve damage could all result in different patterns of unusual pain.

1.5.2 Skincare

The skin of the injected area may show temporary erythema and swelling. Some patients who have very sensitive and fragile skin can show persistent erythema and symptoms of irritation if disinfectants, topical anesthetics, rubbing, molding movements, or even ice packing irritate or disrupt the superficial skin barrier. Postinjection skin should be regularly cleaned with a mild detergent and water. Skincare products and facial masks are not recommended because of their complex ingredients and possible allergens or irritants they may contain. Makeup and sunscreen should not be applied for at least 1 to 3 days depending on the severity of skin surface wounding and irritation. Patients should be taught to avoid contact with chemicals, stimulants, and water of doubtful sources such as a swimming pool, hot spring, sauna, etc. Even the air of a smoky restaurant can irritate the treated skin.

1.5.3 Medications

Postinjection analgesics are usually not needed. Antibiotics should be considered if injectors are concerned that some of the injection processes may have become contaminated or if there are too many puncture wounds when there are previous fillers inside the skin, especially permanent fillers and threads. Antibiotics are also suggested when patients have very oily skin, acne, profuse comedones, or when the injection is within the beard or hair-bearing areas. The present antiviral drugs are usually very effective and can be prepared and taken at the first sign of an outbreak but do not need to be routinely used as a postinjection medication.

Topical arnica and mucopolysaccharide polysulfate (hirudoid) are sometimes prescribed for patients with bleeding during the procedure or visible bruise discoloration to facilitate earlier resolution of the ecchymosis.

1.5.4 Massages and Molding

Molding of injectable fillers in tissue after treatments can help the merging of the filled substance into the peripheral tissue with a smoother transition and correct minor faults of injection asymmetry or contour deviation, adjust the angle and magnitude of projections, and enhance filler integration with tissues. However, overaggressive molding could also spread some of the filler with more fluidity and offset slightly the definition achieved. With regard to tissue integration, a study revealed that massaging at the injection site promoted tissue integration of soft products, as compared to hard fillers. From a clinical perspective, this indicates that molding of soft products allows for homogenization, as more viscous materials can be more easily palpable.

Swelling from tissue reaction to filling substances like CaHA or PCL is usually prominent and might interfere with the judgment of final curves and the endpoint of injection, especially when the injection has proceeded slowly, so that swelling ensued before treatment was completed. Aggressive injections and multiple punctures of the needle can also result in excessive trauma swelling, bruising, and distortion of the tissue. Molding should accompany filler injection immediately after the placement for more precise judgment and more correct adjustments; alternatively, it can be deferred until the resolution of tissue swelling several days after the procedure.

Patients treated by PLLA are usually educated to massage the treated areas five times a day for 5 days. Massages after the injection also help the distribution of this watery injectable material. The massage of PLLA should be symmetrical, even in force, and thoroughly applied for every injected area.

1.5.5 Follow-up

As some soft fillers like HA continue integrating with a tissue after being injected, especially under repeated facial movements, patients should be followed up and adjusted one week after the injection when all the swelling has diminished to make sure the final result is a good and natural shape.

1.6 TOUCH-UP AND REFILL

Different injectable fillers have different longevity. That means if clinical effects are to be maintained they need to be injected after a certain period. The journey of enhancement using injectable fillers should be plotted as a long-term plan. Touch-up with new injections should be minimized to as little as possible. The injection treatment should not be played out like a serial drama that leaves frequent wounds and bruises on patients' faces.

When a refill of the injected area is needed after the recognized period for a certain filler, the same substance should be considered the first choice. Random mixing of fillers or a hit-and-run random pick of products confuses patients and also causes problems for their doctors.

1.7 ULTRASOUND IMAGING

A recent study has shown that ultrasound imaging is a helpful tool when trying to manage adverse vascular events caused by intra-arterial product application (Schelke et al., 2019). The ability to visualize facial soft tissues allows the health-care provider to identify the injection location and the administered product and to target it directly. Ultrasound imaging has received additional attention due to its ability to pre-analyze the vessels of the face and to allow for skin surface markings of arterial blood vessels. This can help and guide the health-care provider toward safer injection procedures if trained appropriately.

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Basic Injection Techniques

2

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Contents

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2.1 INTRODUCTION

Treatment with injectable fillers is the procedure to put filling materials of different characters into tissue to provide volume, change contours, improve tissue quality, provide tissue strength, and give structural support. Different techniques of filler placement involve the control of injection flow, the control of aliquot size, and the deployment of fillers in a certain depth of tissue and in specific patterns. However, these arrangements of filler distribution perform like the mechanics of architecture and can have an impact on the shape of the final façade, the effect of augmentation, and how the whole moves flexibly and naturally with muscles. Basic techniques are the skills fundamental to all the variant and novel techniques; a practitioner should be thoroughly familiar with them before extrapolating them to other advanced techniques.

2.2 DEPOT PLACEMENT

A depot technique is the release of fillers in a single bolus in different layers of tissue. The size of depot can be tiny or several milliliters in size and the dispensing instruments can be sharp needles or cannulas. The purpose of this technique is to confine the filler substance to a certain point for better precision. Multiple depots can be placed together to give more volume, but it has to be ensured that fillers are placed in the desired distribution pattern rather than a random dispersal in tissue or an uncontrolled overflow from a certain targeted point. The array of multiple depots can be linear to simulate a bony ridge, in multiple layer stacking to give more projection, or a three-dimensional like structure adapted to volume deficits (**Figure 2.1**).

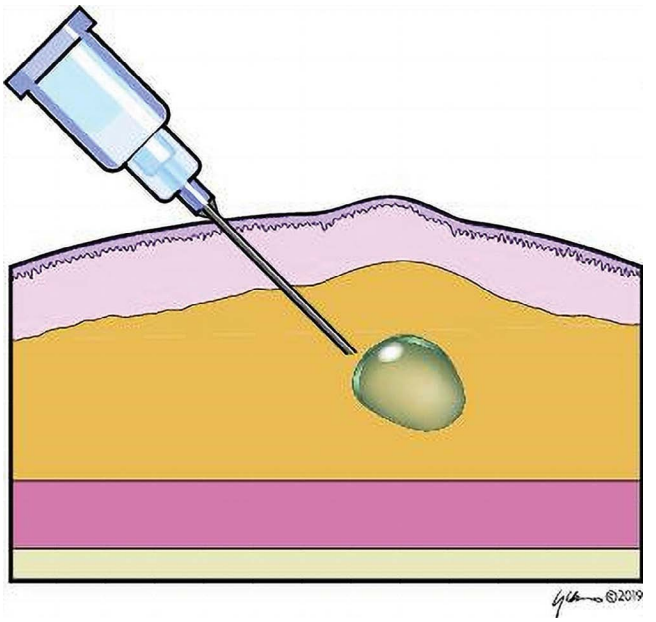

FIGURE 2.1 Depot technique places a droplet of filler material in tissue. This work can be done by a sharp needle or a cannula in the dermis, subcutaneous tissue, next to the periosteum.

2.2.1 Layer

The layered arrangement of the face lies at the core of facial anatomy. It provides a navigation system around sensitive neurovascular structures and allows the practitioner to locate muscles, fat compartments, and ligaments in a standardized fashion. Understanding the layered arrangement of the face provides the fundamental basis for understanding facial biomechanics and the implications of placing soft tissue fillers within specific layers, or across a multitude of layers. In general, the face is composed of five different facial layers, including skin, subcutaneous fat, the superficial musculoaponeurotic system, deep fat, and deep fascia/periosteum. The fascial layers are anchored by septae (i.e., superior and inferior temporal septa; superior, middle, and inferior frontal septa), adhesions (temporal adhesion), and true ligaments (zygomatic, masseteric, mandibular ligaments), at strategic points in the face. The classical five-layered arrangement of the face can be expanded in different facial regions, which will be further elaborated on in the respective chapters. Here, to start, we provide an overview of the general concept of the layered anatomy.

2.2.1.1 Skin (intradermal layer)

The skin is the most superficial layer of the face. It varies in thickness depending on the facial region. It is especially delicate infraorbitally, its transparency leading to visibility of the underlying orbicularis oculi muscle that is responsible for the bluish pigmentation of the region. This area is especially prone to swelling after injection of soft tissue filler. In the midface, the skin is comparably thick. Here, vascularized septa provide loose connections to the subcutaneous fat and the underlying muscles of facial expression.

Most injections claimed to be injected into the skin dermis are often actually injected into the subcutaneous layer. The term “dermal filler” usually confuses both the patients and the injectors. Very superficial depot injection into the dermis is usually indicated for the correction of dermal depressions like wrinkles or shallow depression scars or is carried out in multiple places or a mesotherapy pattern for superficial skin effects.

2.2.1.2 Superficial subcutaneous layer (subdermal fatty layer, superficial fat compartments)

The architecture of the subcutaneous fatty layer of the face differs with regard to its position, medial and lateral to the nasolabial and labiomandibular sulcus. Lateral to the nasolabial sulcus, the subcutaneous tissue is referred to as Ghassemi Type 1 tissue, where fibrous septa enclose lobules of fat cells, compartmentalizing the superficial fat compartments – the nasolabial, jowl, malar or medial, and middle and lateral cheek fat compartments – with loose adhesions between the skin and the superficial musculoaponeurotic system (SMAS). These compartments cover most of the face lateral to the nasolabial and labiomandibular sulcus, excluding the tear trough, the lateral orbital thickening, and the zygomatic arch. Medially, the subcutaneous fat is composed of a dense collagen-muscle fiber network with interposed fat cells with strong adherence between skin and SMAS, referred to as Ghassemi Type 2 tissue. Various cadaveric and in vivo studies have demonstrated high mobility of the superficial fat compartments in the midface, in terms of age-related soft tissue descent, inferior displacement after application of soft tissue filler, as well as cranial movement during facial expressions such as Duchenne-type smiling. During smiling, both the inferior border of the nasolabial fat compartment and the floor of the compartment formed by the orbicularis oculi muscle show a cranial shift toward the infraorbital rim, simultaneously moving the overlying superficial fat compartments in this direction. From the clinical point of view, these findings provide an explanation for the frequently observed increase in nasolabial fold severity after injection of the superficial nasolabial fat compartment. Due to its mobility, an increase of volume enforces descent following gravitational forces, which increases the prominence of the nasolabial sulcus, the inferior boarder of the fat pad, further accelerating the appearance of an aged face.

Soft tissue fillers intended to be placed superficially in the subdermal fatty layer should be thin, soft, small in particle, or have the character to be integrated well with tissues. Except for soft gel hyaluronic

acid (HA) fillers and small particle HA products, poly-L-lactic acid (PLLA) with modified techniques (see Chapter 4) can be applied in a very superficial subdermal pattern. The subdermal depot technique is usually indicated for a shallow depression scar, the correction of minor unevenness, or the gentle enhancement of contours. Depots injected into superficial fat compartments can accentuate facial shapes more efficiently than deep-seated depots; however, volume replacement by fillers should be tailored according to pathognomonic reasons. When the actual lack or loss of volume derives from the bony structures or the deep fat tissue, the new volume is ideally to be placed in deeper layers. When the loss or deficiency is originated from deep but fillers are put superficially, the superficially placed foreign substance can be expected to be more visible and volume efficient. It can even appear normal in static mode but can move awkwardly with the contraction of underlying mimetic muscles. A superficially situated pool of HA without adequate tissue integration can be grouped or present with prominent margins. The light could transmit and be scattered from part of the pool, resulting in an embarrassing transparent appearance or bluish discoloration (colloid light scattering, more often referred to as the Tyndall effect).

2.2.1.3 Deep subcutaneous layer (deep fatty layer, deep fat compartments)

The deep fat differs in size and structure from the fat located within the superficial fatty layer. The deep fat compartments – deep pyriform, deep medial cheek, deep lateral cheek, deep nasolabial, and medial and lateral suborbicularis oculi fat – are bordered by strong fascial sheets, muscles, ligaments, and sensitive neurovascular structures. While the superficial nasolabial and jowl fat compartments show an inferior displacement during aging, the deep fat compartments show volume loss, thereby decreasing the support and projection of the overlying structures and causing deflation of the face. The deep midfacial fat compartments show no significant positional changes during facial expression or facial aging, as confirmed by ultrasound and computed tomography (CT) morphological studies. Thus, restoration of midfacial volume loss should be performed by deep supraperiosteal injections targeting the deep midfacial fat compartments to prevent any engagement with the mobility of the superficial midfacial fat compartments, but rather to create a volumized basis for overlying soft tissue layers.

A bolus deposition into the deep facial fat compartments is perhaps the most frequently used technique to correct facial volume loss and the augmentation of contours. The fat distribution of the face is rather complex and is usually divided into different layers stratified with muscles. Fillers when injected deeply come with fewer concerns about light scattering are less prominent and less volume efficient, and result in changes more modestly. Filler deposit in the deeper fat layer is indicated for major contour depressions when volume deficiency is large or occurs deeply or the overlying soft tissue is thin and is often intended to mimick contours coming from the deeper planes.

2.2.1.4 Near ligaments

Facial ligaments are vertically orientated osteo-cutaneous structures that span the fascial layers in a perpendicular fashion. Most importantly, the temporal ligamentous adhesion (the fusion of the superior and inferior temporal septum), the lateral orbital thickening (the lateral thickening of the orbicularis retaining ligament [ORL]), zygomatic ligament, and the mandibular ligament form the line of ligaments. This line extends immediately lateral to the lateral orbital rim from the temporal crest to the mandible and separates the medial from the lateral midface. The line of ligaments marks the point where the parallel orientated layered arrangement of the midface changes to an oblique orientation with intersections medially, which can be compared to roof tiles overlapping each other. Muscles of facial expression are located medial to the line of ligaments, while muscles involved in mastication (i.e., masseter and temporalis muscle) can also be found lateral to this line. The line of ligaments marks the medial boundary of the superficial middle cheek fat compartment and the lateral boundary of the superficial medial cheek fat compartment. A study investigated skin movement of the medial and lateral midface during repose and smiling, using

three-dimensional surface imaging, and found that the skin moves antagonistically, in the medial midface cranially and laterally, and in the lateral face medially and cranially. Divergence of these antagonistic movements was identified at a vertical line connecting the lateral orbital rim to the inferior end of the labiomandibular sulcus, corresponding to the line of ligaments. It still remains to be determined how these observations can be translated into biomechanical processes accounting for these antagonistic skin displacement patterns – whether the line of ligaments itself forms a functional boundary between the medial and lateral midface or if the contractile force of the muscles of facial expression ends at this line by chance. Subdermal injection of filler materials lateral to the line of ligaments (i.e., temporal, lateral midface, jawline) can induce lifting effects of the face (see Chapter 3 for further details). In addition, targeting major ligaments of the face using soft tissue fillers is currently being keenly discussed. While it has been proven that various facial structures, including skin, fat, muscles, and bone, change their constitution and position during the aging process, it has also been hypothesized that facial ligaments change their position following structural changes and the effects of gravity. As an example, the orientation of the ORL, which attaches to the infraorbital rim and forms a 90° angle with the maxilla in young patients, displaces inferiorly, resulting in a more acute angle. In theory, placing the filler material near facial ligaments can re-adjust the ligament orientation.

Bolus depot at the points of ligament insertion has been employed to give support. Ligaments of the face include true ligaments that attach directly to the bone and false ligaments connecting between fascia and the skin. Bolus injection on the connecting points of a false ligament is a deposition among soft tissues that move. These points are often presented as facial depressions when facial skin and soft tissue have become less full and less strong, sagging under gravity. Adding volume in points here plays a role in camouflaging suboptimal curves rather than giving support. True ligaments that attach to the bone appear more fixed and condensed in structure. Injection at the points of true ligament insertion probably can increase tension and correct some of the sagging curves – for example, the injection at points deep to the malar groove. However, the alleged lifting effect for solving sagging and chubbiness is usually a proportional visual effect without evidence to prove it. Fillers with stronger consistency provide better support in these situations but would result in more and longer pain.

2.2.1.5 Supraperiosteal

Bolus deposition of soft tissue fillers deep at the supraperiosteal plane augments the volume more diffusely and less prominently as the newly added volume has to be detected through the stratified overlying soft tissue. The clinical effect can be considered subtle, but on a novice hand, suboptimal distribution or wrong dosing of the soft tissue filler would be less perceptible as well. Deep-seated soft tissue fillers staying at deep space are less pulled and compressed by the overlying mimetic muscles. Faults occurring during injection result in less noticeable unnatural contours for facial movements. However, the clinical effect of augmentation works through lifting up the bulk of soft tissue. That is why some of the clinical effects or improvements look good initially but fade or disappear quickly.

The effect of deeply placed fillers is mostly limited to the region where it is applied. This can be seen when taking a closer look at deep supraperiosteal filler injections in the temple region. From an anatomic perspective, this technique applies the product deep to the deep temporal fascia, which is strongly connected to the temporal crest and the lateral orbital rim and provides a tight border to where the product is placed. Thus, deep injections can help achieve local volumization but will most likely not achieve further aesthetic effects. Interestingly, subperiosteal injections (a potential facial safe zone) are not feasible, as revealed by cadaveric dissections after filler injection with different needle sizes and injection angles.

2.2.2 Aliquot

The aliquot size of the bolus depot should be adjusted according to filler character and the depth of injection. The superficial deposit of filler should be small in size. With some soft HA, for example, the aliquot per depot for correcting the superficial depression or scars usually comes as a trace to 0.01 ml or

less. Calcium hydroxylapatite (CaHA) or polycaprolactone (PCL) when being deposited in the deep fat compartment for replacing volume deficiency in bolus should be limited in size as these filler substances could be firm in consistency after solidification. When being grouped as a large bolus, they can become aggregate nodules. HA fillers with softer character can be placed in a bigger size as molding and massages can spread the HA easily to the surrounding tissue and leave less unevenness or nodularity. However, granular HA fillers or HA fillers with higher elasticity and viscosity are often confined to the targeted place of injection with a limited spreading tendency. Stronger HA fillers sit more fixedly in tissue, but when they are deposited in a big bolus, the filler particles are not stable with each other and could present as a cyst or a bag and move awkwardly with muscles. Reconstituted PLLA is a filler with physical property almost like a fluid and is often used for deep tissue augmentation. Though the depot of watery PLLA solutions can be and usually is firmly massaged to facilitate its spreading, a single large bolus of PLLA adapts less well than multiple smaller PLLA depots to the right facial contours in their spatial arrangement.

2.2.3 Instrument

The depot technique can be delivered by sharp needles or blunt cannulas. For the depots intended for the level of the supraperiosteal layer or multiple layers, the cannula would not be the instrument of choice to accomplish this job. However, the cannula could still deliver a depot of filler in a single point or multiple points in the same compartment or could cross weak borders without difficulty.

2.2.3.1 Needles

The very superficial depots of filler in dermis can only be accomplished by a good technique and with needles. The vascular structures in the dermis are grossly fine and almost the end of branches, which ensures injection in the dermis is generally safe and even bloodless. The supraperiosteal plane injection – especially when multiple points deposition is required – should also be performed with needles. A cannula can usually reach the bone under the guidance of a needle, which largely offsets the benefits of using a cannula. Blunt instruments have more difficulty penetrating across multiple barriers of the fascia. When the targets are the supraperiosteal plane and needles are used to approach the points, a perpendicular scheme shortens the route. Pointing the bevel down and using adequate aspiration are suggested to keep injection away from the vessels. Watery fillers like PLLA should also be delivered by needles rather than a cannula for better precision. Fillers with the characteristic of high fluidity soon leak out from the instrument holes under minimal plunger pressure and flow easily in the tracts where the cannula passed; all the intended depots could become a random flow.

2.2.3.2 Cannula

The cannula is preferred in areas with more vulnerable tissue and complex vascular structures. However, using a cannula is not a guarantee for safety. The tip of a fine cannula is as sharp as a needle, while the blunt tip of a thick cannula usually has to be exercised with force to counteract more resistance. Advance slowly and gently when impedance from the tissue occurs and stops when patients report pain. It is preferable to augment the superficial fatty layer with a cannula. When the injection with cannula is within the subcutaneous soft tissue, pushing the plunger should be more restrained because resistance is lower and incidental flows could become more.

2.2.4 Advantages and Limitations

The depot technique augmenting tissue with limited points has the benefit of precision in a specific location and a certain amount (**Figure 2.2**). When planning for augmentation covering a wider region or in more superficial plans, more punctures are needed.

FIGURE 2.2 Submuscular temporal injection is a typical depot technique with needles directly touching the bone. Restylane Defyne is used in this young female for the purpose of easier redistribution and providing definite lifting below the temporalis muscle.

2.3 SERIAL PUNCTURE

Serial puncture is a technique that delivers a series of a small bolus of filler covering an area to provide volume or modify the skin (**Figure 2.3**).

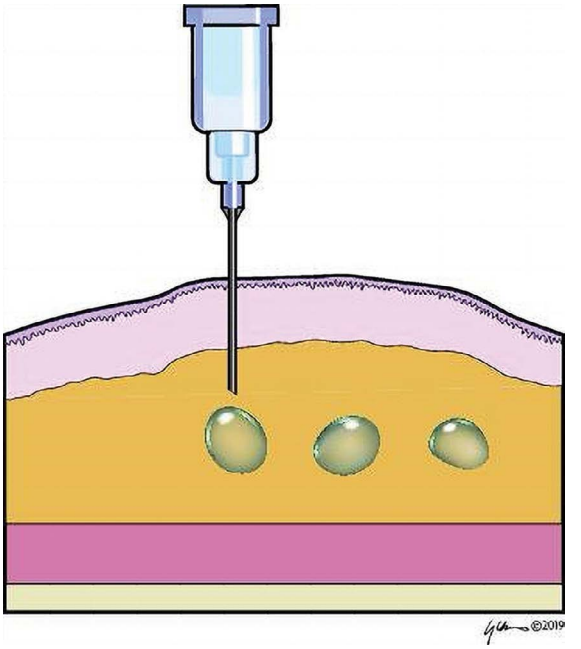

FIGURE 2.3 Serial puncture delivers multiple smaller droplets of fillers to compose a complex volume or cover a broader area.

FIGURE 2.4 Serial punctures separate the multiple depots in tissue, providing different injectable functions. Restylane Skinbooster is used in this young female in the lower face to smooth the transition of jowl fat bulging to the chin.

2.3.1 Layer

Serial puncture injection usually finishes with multiple actions of needle insertion with a limited amount of filler deposition. It is a technique usually indicated for superficial structures like the dermis or superficial fat tissue (**Figure 2.4**). The principle for choice of filler is the same as a superficial depot (see Section 2.2.1.1). The level of injection in multiple punctures should be equal for every needle puncture to ensure the augmenting effect from the injections will be even. Aliquot size should also be equal. However, for the next level of artistic augmentation, different depots can be arranged differently and in different sizes adapting to regional requirements.

2.3.2 Advantages and Limitations

Though a serial puncture technique is often considered basic and frequently used by beginners, control of every puncture to ensure it is at the same level and in equal size is not easy. A superficial injection is usually safe, but multiple insertions of the needle are more wounding and can result in bad bruises and severe discomfort in less experienced hands (**Figure 2.5a** and **b**).

2.4 LINEAR THREADING

Linear threading augments a linear space with a single entry of needle or cannula and dispenses filler materials along the passage of the instrument. To have consistent placing of filler substance, the whole thread should be kept at the same level. That means the needle or cannula should be inserted and penetrate the tissue in the same depth after touching the skin. Pushing the plunger and moving the instruments should be coordinated at a steady pace; in other words, the aim is to leave a thread of filler without breaks and in the same caliber along the tract of passage.

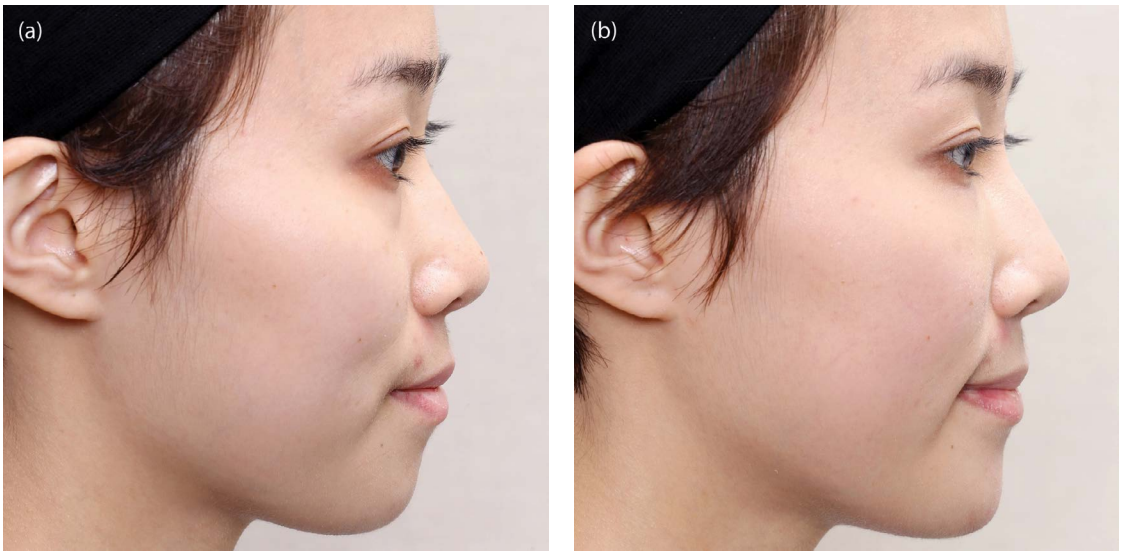

FIGURE 2.5 Serial puncture could be used wisely and artistically for some delicate contouring purposes. Nose length/height and chin projection are enhanced in this young female by Restylane Lyft by tower and depot techniques. (a and b) While there are suboptimal and depressive curves below the eye, the nasolabial and labiomental folds are corrected by Restylane Skinbooster in multiple serial punctures.

2.4.1 Layer

Some morphological problems or volume deficiencies are present in linear patterns, such as bony ridges, furrows, or wrinkles. All these linear threads need to be layered in different depths. The practical injection of fillers often performs with multiple linear threads combined in different arrays to become a modified spatial distribution such as fanning or cross-hatching. It is a technique that injectors must be equipped with.

2.4.1.1 Intradermal

The principle of selecting fillers for superficial intradermal threading is similar to that described above (see Section 2.2.1.1). Intradermal linear threading is usually used for the correction of shallow wrinkles and horizontal necklines. The special technique of linear injection in the very superficial dermis is called blanching technique (Section 3.3).

2.4.1.2 Subcutaneous

The linear distribution of filler in the subcutaneous plane can enhance shape in a linear pattern, give definitions, or correct depression grooves and furrows. The problem of a long passage in the subcutaneous tissue is that vessels can cross the intended way while any advancement of the instruments is in effect blind. Though there have been ideas about anterograde injection, retrograde deposition is more recommended as being safer, more informed, and more controllable (**Figure 2.6**).

2.4.1.3 Supraperiosteal

Needles and cannulas are instruments with reasonable rigidity and could hardly adhere to the bone along a linear track. Supraperiosteal linear threading is usually partially within the muscle – or even the

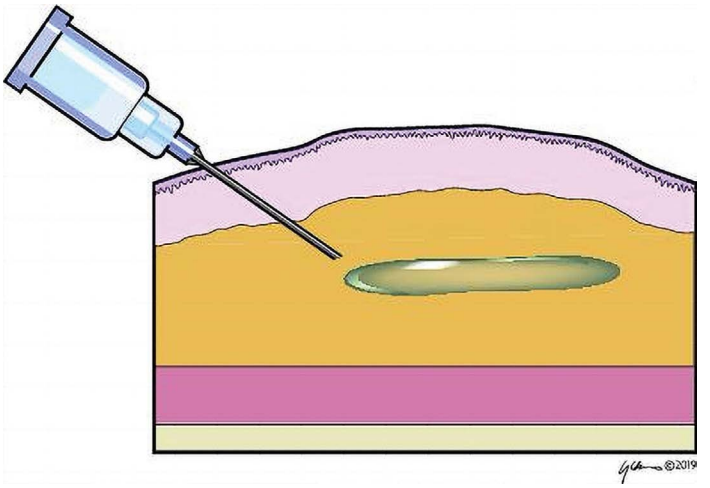

FIGURE 2.6 Steady pushing of the plunger during needle movements leaves the filler in a thread-like pattern in tissue, resulting in linear-patterned augmentation.

supramuscular fat layer – and partially in the supraperiosteal plane. The supraperiosteal space is also the plane that some deep vasculature penetrates. Linear injection deeply along the bone should be kept away from the danger zones where these deep vessels penetrate. All these conditions make supraperiosteal linear injection not much employed in real practice.

2.4.2 Instrument

Both needles and cannulas can be employed in performing this technique. The bevel of the needle and the opening of the cannula should be carefully controlled toward the right direction (**Figure 2.7**), especially when the injection is shallow or under thin skins. For neckline treatment or for erasing fine wrinkles with

FIGURE 2.7 Injectable nasal augmentation could be carried out as multiple bolus depots or as oblique threading across tissue planes. Restylane Defyne is used in this case at the nasal dorsum by this technique to limit lateral spread and to keep alignment with the midline. The injector should adjust the bevel down, touch the bone, and aspirate enough to ensure safety. A lateral-directed bevel could lead to deviated augmentation.

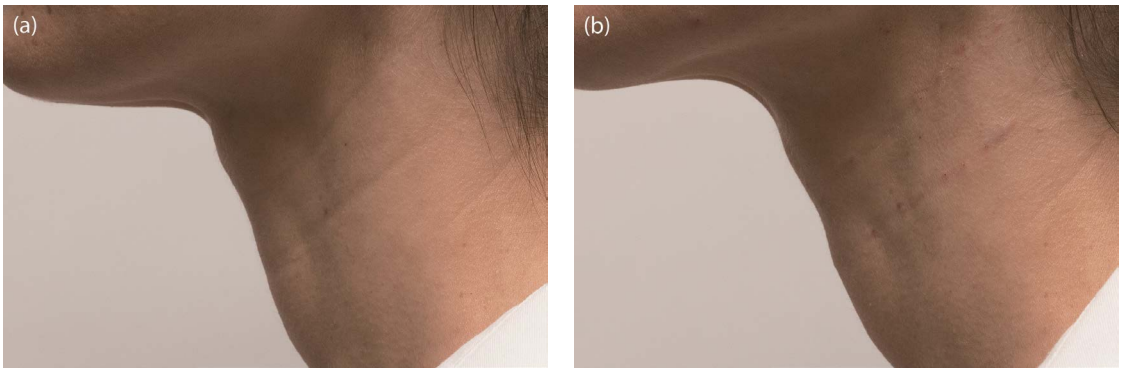

FIGURE 2.8 Neckline filler correction is a typical treatment using linear threading technique. This middle-aged Caucasian female (a) received diluted CaHA neckline needle injection. Original 1.5-ml Radiesse is premixed with 1.5 ml of lidocaine and injected with a 27-gauge 1/2-inch sharp needle with bevel down. Necklines are much improved 2 weeks after the injection (b).

needles and HA fillers, the injection should proceed with bevels up in thicker skins and could be considered with bevels down for thinner skins but is not recommended with holes and bevels opened laterally (**Figure 2.8a** and **b**).

2.4.3 Advantages and Limitations

Continuous laying of fillers in a linear pattern can give a continuous well-grouped volume. That provides more solid contours when compared with the volume augmented with multiple dots. A thick thread with soft fillers grouped could provide support and look good for a while; however, some soft substances creep and deform with time according to its physical characteristics and how it is distributed in tissue. That is why some nose augmentation shows gradual widening.

2.5 PARALLEL LINEAR

When the linear technique is used singly, it is only good for minimal linear volume deficits. However, when there is a big gap in the deficit, a thick thread might not be enough or a good idea to provide more volume: HA fillers are physically colloid gels and will behave with fluidity when collected together, so a semifluid thick rope will eventually deform and collapse and the clinical outcome (as mentioned above) will be widening, imprecise bulging, or unclear shapes. Multiple linear threading is a modified technique to stack different linear threads together with tissue separating and spacing them apart (**Figure 2.9a**).

Multiple linear threads when combined in a horizontal pattern can cover a wider surface and provide volume other than in a linear shape (**Figure 2.9b**).

2.5.1 Instrument

Using a cannula in tissue requires entry holes created by needles (**Figure 2.10**). Multiple linear injections need multiple entry holes, which limits the flexibility of a cannula for this application.

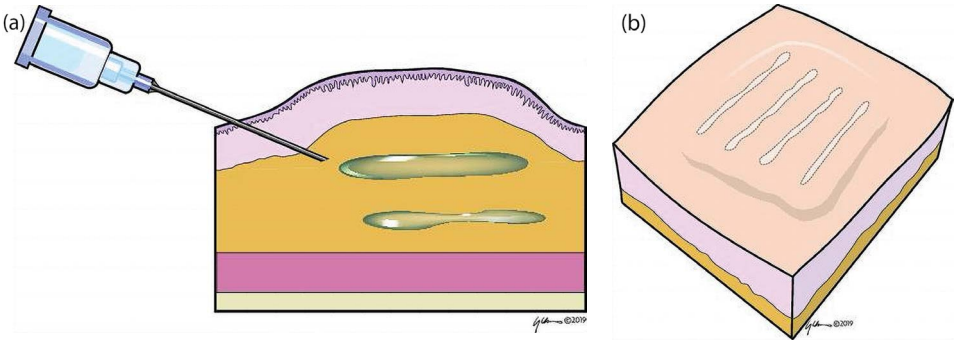

FIGURE 2.9 Multiple linear threads of fillers can be stacked to give more volume and more projection (a). Linear threading can be multiplied over a distance to cover a broader area and maintain thin distribution (b).

FIGURE 2.10 Jawline augmentation often adopts the multiple linear threading technique for giving a more prominent effect. Radiesse is used in this female patient via a single entry hole and a surgical cannula to augment the jawline and chin.

2.5.2 Advantages and Limitations

The benefit of the parallel linear technique is that it fortifies the volumizing effect of fillers (**Figure 2.11a** and **b**) when stacking multiple filler threads together – whether in a vertical way or horizontally – to give different shapes and cover an area bigger and wider than just a line. When a uniform sheetlike volume is needed, the parallel linear technique can cover the area with less puncture wounding than do multiple punctures but with more entries than does fanning. Even in an experienced hand, the multiple entries and needle wounds of the skin could result in more bleeding and bruising.

2.6 FANNING

When the volume deficit is an area more than a linear distribution of filler can cover, fanning is a technique modified from linear threading, withdrawing, and reinserting the needle dispensing fillers in approximately the same level of tissue but in a deviated angle. Redirecting the needle means the injection is performed via the same entry hole approaching tissues more widely than does an individual thread.

FIGURE 2.11 Parallel linear threads can fortify the augmenting effect and give stronger shapes. Juvederm volume is used in this muscular Caucasian patient (a) to enhance the mandibular shape and angle. Multiple linear threads of the HA gel are stacked together to give enough jawline definition (b).

It is indicated for the versatile volume or contour demands of a wedge, corner, groove, slope, etc. (**Figure 2.12a** and **b**).

2.6.1 Instrument

With needle sharp edges, fanning injection can be accomplished in a more superficial layer of tissue that is composed of more connective tissue fibers. Needle fanning usually can result in more delicate work with more passes and a lesser amount of filler in each pass. Many fanning works are done by a cannula but the blunt tips of the cannula have to face more resistance and it is less easy to be precise in targeting a certain point and to accomplish as many rounds of threading as would the needle, especially when the injection is within an area with a more fibrotic structure or when the injection approaches the dermis.

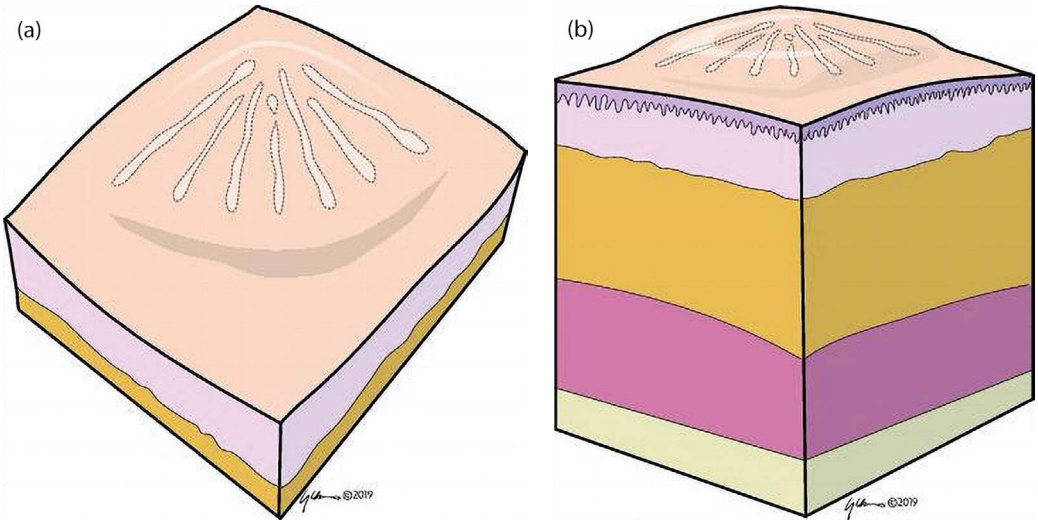

FIGURE 2.12 When multiple linear threading is arranged like a fan via one entry hole (a), it covers a larger area and creates a fan-shaped elevation (b), but the filler density is unequal when compared with the edge and root of a fan.

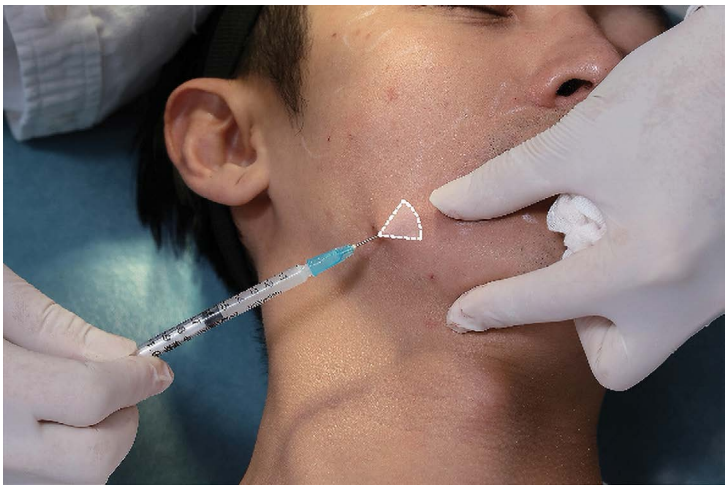

FIGURE 2.13 PLLA injection for superficial soft tissue often needs delicate and even distribution of the liquid suspension, which can be achieved by fanning injection with a sharp needle.

2.6.2 Advantages and Limitations

Multiple injections passing via one entry hole can decrease surface skin wounding. However, the extent of tissue trauma and the possibility of vessel damage would not be lessened. Bleeding and bruising could be severe if a rupture of the vessel occurs during the procedure without being noted in time. Fanning is supposed to provide an even distribution of filler but the evenness has the premise that every component of the fan should be placed at an equal distance and every linear threading is performed well with an equal and steady amount of filler. The limitation of a fanning technique is its unequal coverage. The base of a fan has the linear threads closer together, while linear threads are distributed more loosely at the arc end of the fan. Sometimes fillers are over-aggregated near the entry point and result in nodules. An artistic fanning should adapt to regional volume deficits and adjust the dispensing amount along the way in a different passage. The fan is only a route pattern for the needle or cannula to tour the necessary points within the territory of one entry point (**Figure 2.13**).

2.7 CROSS-HATCHING AND CROSS FANNING

When the injection is indicated for a large area that cannot be covered by only a single fan (the diameter of a needle span), then the injection work needs the combination of multiple fans. With multiple fans to cover an area, the injector can adjust the direction of the looser part and the denser part of a fan to overlap slightly, to correct to some degree the uneven problems of a single fan. Cross-hatching is a technique more like the perpendicular overlapping of parallel linear threads when the volume deficits are more severe and a single layer of parallel linear cannot give enough augment. The overlapping angles do not necessarily have to be 90° and can be adjusted following the tissue tension lines and the weight on the flexion/extension direction to give more support and tissue strength (**Figure 2.14a** and **b**).

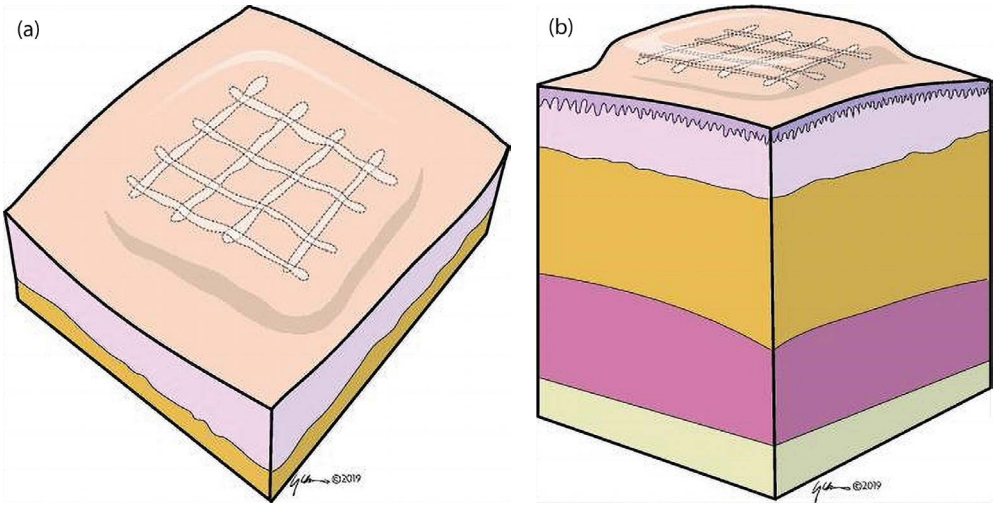

FIGURE 2.14 (a) When one layer of horizontal parallel linear threading is overlapped with another one, it becomes cross-hatching. (b) This gives double the density and double the amount of filler but also creates double the number of skin breaks and more chances of bruising.

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3 Modified and Advanced Injection Techniques

Yates Yen-Yu Chao, Sebastian Cotofana, and Nicholas Moellhoff

Contents

3.1 INTRODUCTION

As a form of art, medical aesthetic injection can be comparable with architecture or sculpture using both foreign substances and self-tissue. The basic techniques of injection are fundamentally to lay volume and build up shape; basic techniques can be modified or combined to meet different clinical and anatomical challenges. Some techniques below are introduced and commented on for completeness; the title of "advanced" means they have higher complexity in technique, not that they are superior or better in terms of safety or efficiency.

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3.2 SUPERFICIAL MULTIPLE MICROPUNCTURE

Emerging in the 1950s, the practice of multiple superficial microinjections of various substances was the beginning of so-called mesotherapy. Though popular in some areas of Europe and South America, this kind of treatment was well accepted more widely because of the lack of clinical and scientific evidence. With the fast growth of injectable medicine in recent decades, more and more studies on the effect of mesotherapy have been conducted. Some of them also used injectable fillers, while the ingredients can be commercial injectable fillers alone or mixed with vitamins, drugs, etc. Different studies reported efficacy in pain control, hair growth, fat reduction, and skin enhancement. Some controversies remain about adverse events and the ingredients used for injection.

Hyaluronic acid (HA) gels of tiny particles or a soft character have been marketed for this pattern of injection to improve skin quality. Studies based on this purpose have shown the effect of HA meso-like injection in hydration status and skin turgor. However, the numerous puncture wounds of needle have a tissue reaction and clinical effect like microneedling that involves tissue trauma, inflammation, and healing with tissue regeneration as well.

The introduction of each puncture of meso injection involves a minimal amount of substance. There are machines equipped with multiple needles to deliver a trace amount of the substance finer than can be done by human hands. For a 1-ml syringe of HA filler, with the injection multi-needle gun, it can be divided into more than 2000 shots.

However, a mesotherapy-like treatment pattern has its inherent problems and concerns. Multiple entries of a needle result in numerous needle wounds that break down the skin barrier and leave the skin vulnerable to the invasion of pathogens under suboptimal conditions. Bleeding occurs during the repeated puncturing procedure, especially by the multi-needle meso-gun. Usually, the gun has to contact the skin again and again, and the needles have to reinsert the skin hundreds of times. Repeated wipes of the gauze to stop the bleeding and the continuous puncture all make the whole procedure difficult to be kept clean.

That is why complications of infection, including atypical mycobacteria inoculation, occurred more than with the usual practice of filler injection. Microneedling, mesotherapy, and meso-patterned filler injection have different levels of danger when infection occurs because filler substances usually stay within tissue before decomposition much longer. Other complications of similar treatment patterns include necrosis of skin and scar formation.

Multiple superficial punctures are suggested to be performed regionally and well controlled for aseptic conditions and bleeding problems. The superficial minimal amount of multiple filler deposition can be modified further to improve not only skin quality but also wrinkles and minimal contour adjustment.

3.3 BLANCHING TECHNIQUE

A very superficial injection has been described for the products of cohesive HA fillers. The softer gel HA can be precisely delivered to the upper reticular dermis at the depth of about 600 μm (**Figure 3.1**). Aiming for the targeted superficial plane, shorter needles of 1/2 inch are preferable for better control of depth. To be inserted in this thin tissue, needles have to be fine, in a 30 gauge or thinner caliber. Because of the cohesivity of these soft gels, the impedance from traveling through lumens of the needle could be higher. The requirements of fine caliber and wide lumen dictate the choice of a thin-walled needle design. In this technique, the fine needles should be inserted almost horizontally parallel to the skin surface at an acute angle less than 15° (**Figure 3.2**). Multiple punctures with short passes of the needle, deploying the minimal amount of HA, are needed to complete the correction of an area of wrinkle. This is delicate and fairly time consuming.

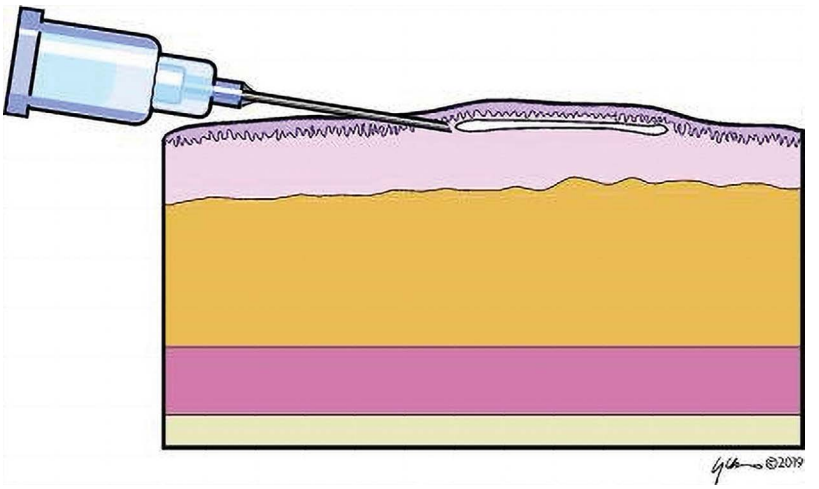

FIGURE 3.1 Superficial linear threading in the dermis is usually indicated for the filling of superficial fine lines.

Studies on HA filler in tissue have found different patterns of filler distribution under the microscope and soft tissue ultrasound. When HA filaments are added to the dermal tissue that is full of connective tissue fibers and intercellular matrix, some fillers can permeate between tissue fibers, displaying unique homogeneous ultrasound signals and uniform widening of the gap between fibers. To achieve good tissue integration, HA fillers have to be homogeneous and fine in component filaments showing reasonable affinity with each other and with the tissue.

Molding after the deployment of HA filler in tissue is an important part of the technique that redistributes the HA filaments. When the injection of HA is administrated too deeply, the effect of gap sealing is turned into one of stuffing under the whole thickness of the skin and becomes ineffective. Blanching of the skin comes from distension of the transparent foreign substance in a very superficial plane that expels the superficial circulation and causes blood displacement. The blanching is transient and usually lasts less than 10 minutes. It should be differentiated from the blanching reaction due to intra-arterial injection

FIGURE 3.2 For a very superficial injection, the needle has to be fine enough (30–32 gauge) and inserted skillfully to be parallel with the skin surface and at a shallow depth. Belotero Balance is used in this case to obliterate the static crow's feet lines.

FIGURE 3.3 Static fine wrinkles that are unresponsive to botulinum toxin (a) can be treated by the blanching injection of HA. Belotero Balance is delivered by this technique in a trace amount. The immediate post-injection picture (b) shows much improved wrinkles with minimal redness at the needle entry points.

by the usual absence of pain, the extent of the blanching being limited to the route of the passing needle (progressively following the retrograde withdrawal movement of the needle), a gradual disappearance in minutes, and the changes occurring in a very superficial tissue plane.

When the same maneuver is applied to some fillers with limited redistributable properties, problems of beading and visible transparency will ensue. Blanching application is only for certain HA fillers and advanced injectors (**Figure 3.3a** and **b**).

3.4 VERTICAL LINEAR AND TOWER TECHNIQUE

The tower technique has been recorded in the literature since 2011 but it had been a usual practice for some time as a variation of the bone depot technique. As a bolus depot on bone, originally intended to give support, does not suffice for some contouring or supporting requirements (especially when HA with limited lifting capacity was employed), the filler substance was dispensed along the way when the needle was withdrawn from the bone with a gradual tapering in amount (**Figure 3.4a–c**). The product will be distributed along the way across different tissue planes and be restricted in the tract of a needle with limited lateral spreading and is supposed to provide more volume in the vertical dimension and give stronger support to combat pressure in the vertical direction.

As more and more cadaver studies have found, filler injected into a bolus pattern can reflux back along the way of the needle tract and possibly get into vessels, resulting in adverse events. This kind of injection was questioned by some practitioners for its safety. Because the tower injection is a dynamic process during the stage of needle withdrawal, aspiration is not practical. However, tips to keep the injection safer include to keep the needle moving, look out for vessels both by vision and palpation, know the anatomy, listen to the patient, and be modest in dosing along the way.

Compared with a single bolus technique whether on the bony plane or in the subcutaneous level, a vertical linear injection or tower technique could provide stronger support and better lifting efficacy (**Figure 3.5**).

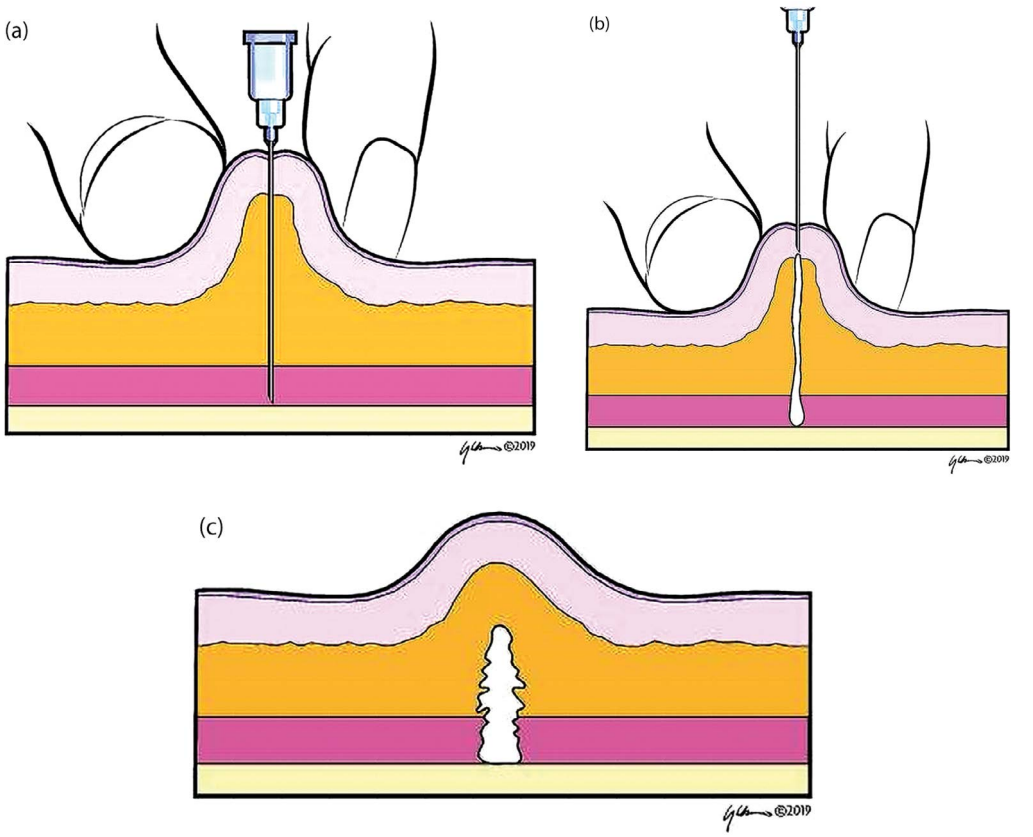

FIGURE 3.4 (a) The tower technique needs the guiding hand to pinch the skin and prolong the traveling pass of the needle. (b) The needle is usually inserted perpendicularly touching the bone. (c) Steady extrusion of fillers is performed during the process of needle withdrawal. The filler is then limited in distribution along the original tract and gives more projection than bone depot would only when the pinch is released.

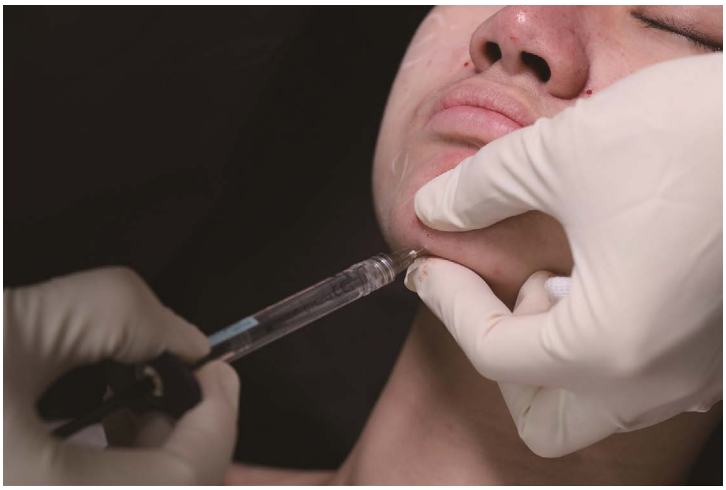

FIGURE 3.5 The tower technique is often indicated in structures that need more projection. Restylane Defyne is used in this young female patient for chin augmentation by the tower technique.

FIGURE 3.6 Projection of the chin can pull on soft tissue in jowl area for a tightened appearance. The tower technique can magnify these augmentations for dimension, projection, and stretching of the skin. Restylane Lyft is used in this young female patient (a and b). Mild erythema is still noticeable days after the procedure.

In cases where there are a severe bone deficiency, thick skin, and a heavy face, or when limited selections of filler are available, it is a valuable technique to give projection and definition.

The blunt tip of cannula cannot easily get through multiple tissue layers perpendicularly – especially through fascia – without an entry pass created by the puncture of the needle. The tower technique is not practical using a cannula. However, the narratives of articles discussing this technique and its safety based on its use in the nasolabial fold and marionette lines should be reevaluated because the tower technique is not typically or necessarily indicated in these areas that are full of vascular concerns.

Every injection technique – whether via a needle or by a cannula – carries a certain level of risk and should be modified or guided to work safely. The tower technique should be used in bony ridges to provide extraordinary support. Needle aspiration – although not a guarantee of safety – could protect from an obvious intravascular injection. As noted above, use the guiding hand to pinch the tissue, keep the needle moving, inject in a retrograde pattern, and use a modest amount of filler per passage (**Figure 3.6a** and **b**).

3.5 FERN LEAF PATTERN INJECTION

Depression of contour or tissue grooves could result from volume loss or volume displacement. The sliding of the soft tissue due to laxity creates gaps and discrepancies between compartments. The nasolabial fold is one of these examples. Injection of fillers in the nasolabial groove is usually not a treatment directed toward the underlying pathognomonic reason but one camouflaging shadow and balancing these gaps. The fern-leaf-patterned injection has been described as useful for treating nasolabial folds (**Figure 3.7**). The underlying mechanism of a smaller amount of filler providing similar correcting results comes from the tenting effect of the foreign substance in tissue. The fern-leaf technique has side stents providing additional support other than the central linear thread and reducing filler consumption (**Figure 3.8**). Though it looks similar after injection, the lesser investment yields less by way of reward. The correction effect usually lasts for a shorter period as soft fillers gradually merge with tissue and adapt to the regional pressure (**Figure 3.9a** and **b**).

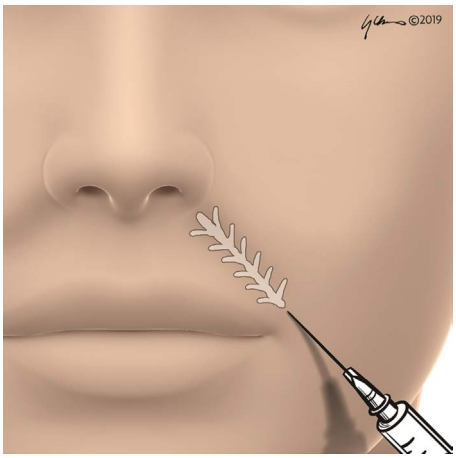

FIGURE 3.7 Grooves of the nasolabial area can be corrected with filler injection along the trough and with periodic crossing threads of fillers to give better mechanical support.

FIGURE 3.8 The crossing injection could deviate from the main groove in a fern-leaf pattern or could directly cross it with insertion of the needle from the side.

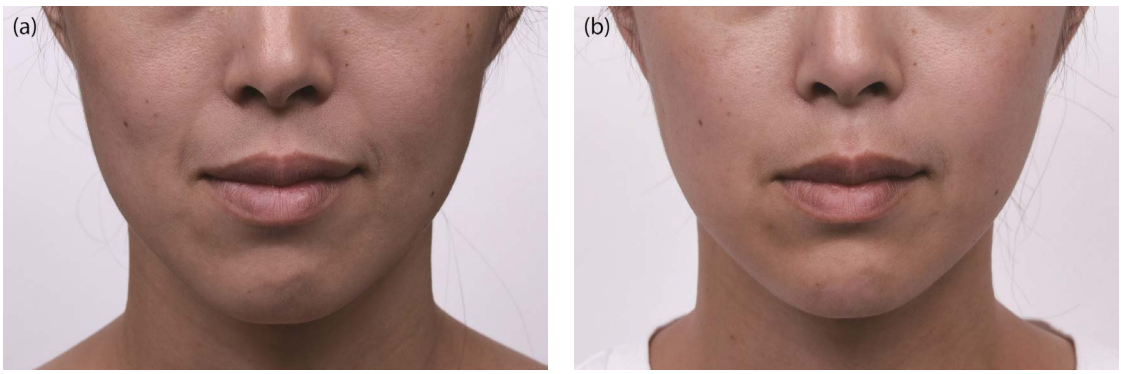

FIGURE 3.9 (a and b) A fern-leaf-like or rail-like pattern of injection is actually a tenting effect similar to the tower technique, counteracting the pushing of the heavy mid-cheek soft tissue. It saves on filler use and is good in mechanical strength and natural facial dynamicity.

3.6 LIGAMENT LIFT

Filler augmentation performed over a bony prominence provides support and buttresses the soft sagging tissue in a way that can be compared with the padding above a shoulder in a jacket pulling the cloth up and making the suit look tightened and fitting. Similarly, the filler on bony ridges like cheekbones or brow ridges has some impact on the neighboring skin; what is different is that clothes are separate from and can slide over the body, while skin and soft tissue (including fascia and muscle) remain tightly bonded with each other throughout the injection treatment.

Filler procedures were marketed in the past few years for lifting purposes rather than as volume replacement. Some theories tried to link the effect of correction with the function of the retaining ligaments. The so-called lifting effects of these filler-lifting campaigns can be divided into three categories, as follows:

1. The buttressing effect of fillers on an upper prominent bony point that causes some tension in neighboring tissue, especially the tissue below it (**Figure 3.10**)
2. The pulling and stretching effect on a lower prominent bony point that increases some of the dimension and tightens the skin slightly
3. The filling and smoothening of depression gaps that could be interpreted as sagging effects, to achieve a lifted-like appearance (**Figure 3.11a–d**)

FIGURE 3.10 Injection on the bone especially in framing areas could augment the dimension and projection that give support to the soft tissue. When the injection is near the retaining ligaments, its effect has been unduly associated with these fixing structures.

FIGURE 3.11 The improvement from (a) to (b) is prominent and often said to be caused by lifting by injectable fillers. However, the mechanism of these morphological improvements can be attributed partly to the higher position of landmarks, like brow and cheekbone projection, that give better support. (c) Note that the eyelid and cheek soft tissue is not moved or elevated after these injections [compare (c) and (a)]. (d) A lifted appearance is the result of injections on bony ridges that give support (white spots) and the filling of hollowness (dashed circles) that gives a fuller and lifted curve. Restylane Lyft is used in this case for cheekbone and chin injection; Restylane Volyme is used for filling the cheek depressions.

Some of these prominent bony ridges have the distribution of true ligaments; however, injection of fillers into these prominent points shows similar results and does not seem to be related to whether the points are on ligaments or not.

Depending on the facial region injected, soft tissue fillers can induce local volume effects and local and regional lifting effects. From an anatomical viewpoint, there are some explanations for lifting effects when performing soft tissue filler injections in certain facial regions, with clinical implications for pan-facial treatments. The facial layers are arranged differently with regard to the line of ligaments. While they are orientated obliquely and medially, they are orientated strictly parallel laterally, which has implications for filler injections. The medial face is a region of high active mobility, mediated by the muscles of facial expression, while the lateral face exerts passive mobility, due to the lack of fixation of the parallel orientated fascial layers as no muscles or major ligaments connect them to the deep fascia or periosteum. Studies have shown that injection of filler material lateral to the line of ligaments first, in a full-face approach, required significantly less product injection medially to achieve an aesthetically pleasing outcome. Targeting lateral injection points first can cause posterolateral lifting and stretching of medially and inferiorly located facial soft tissues. This has been demonstrated for both superficial injections in the temple and deep injections with contact to the bone of the lateral suborbicularis oculi fat (SOOF) compartment, midportion of the zygomatic arch, and the highest point of the malar eminence (deep lateral cheek fat). The lifting effect is based on the following mechanisms. Subdermal injections into the posterior and superior temples are placed superficial to the superficial temporal fascia, within the superficial inferior temporal fat compartment in the subcutaneous fatty layer. While other superficial fat compartments, such as the superficial nasolabial and jowl fat compartment, show age-related inferior displacement, previous investigations have demonstrated the stability of the inferior temporal fat, independent of the amount of product placement. The increase of volume in this fat compartment then leads to repositioning of midfacial and lower face soft tissues due to the connections of the fascial layers via strong subdermal septae, adhesions along the zygomatic arch and the parotid region. Furthermore, lateral injections result in a stretching and flattening effect of the midfacial soft tissues by stretching the parallel arrangement of the facial layers lateral to the line of ligaments. To summarize, the lifting effects result from an interaction between dermis, subcutaneous fat, subdermal fibrous septae, and superficial fascia. Injection of soft tissue filler in the lateral face first leads to an increase of facial tone, in turn causing more apparent surface projection of medial injections, cranial repositioning of lower facial regions, such as the jawline, and volume reduction in the lower face. Generally speaking, studies have indicated that lateral injections, as opposed to medial injections, induce regional lifting effects in adjacent lateral facial regions, while medial injections can cause local lifting effects in addition to volumization. Due to these biomechanical effects based on the fascial arrangement of the face, the lateral face first and upper face first injection algorithms were proposed for pan-facial treatments.

Injection of the filler itself increases volume. Filling with fillers should always be tailored for the concern of an optimal endpoint volume, not a lifting effect (**Figure 3.12**). Overenthusiasm for lifting could conversely widen and exaggerate a bony prominence, which is a result the patients will not welcome.

3.7 INTERFASCIAL INJECTION

Injection techniques should be modified according to regional structures and anatomy considerations. There are some areas where a fascia expands as a plane and therefore is a good structure for guiding and distributing the injected filler material. This well-defined fascial arrangement can be found in the dorsum of hands, the neck, and the temporal area.

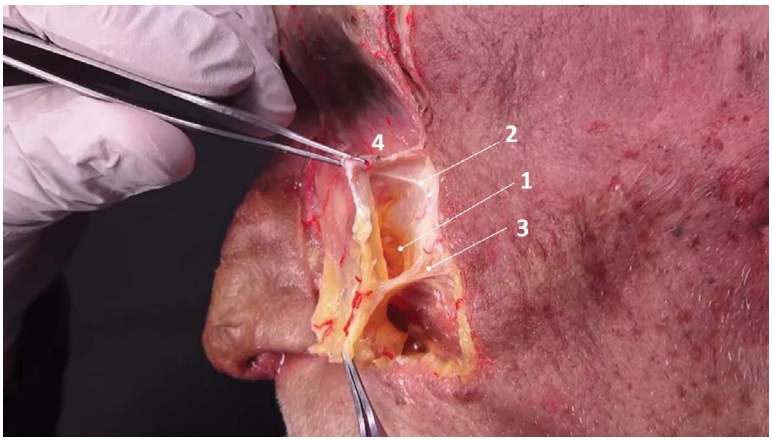

FIGURE 3.12 Cadaveric dissection of the left infraorbital area, highlighting the ligamentous borders of the SOOF (1). The orbicularis retaining ligament (2) and zygomatico-cutaneous ligament (3) are shown. (4) Orbicularis oculi muscle (OOM).

3.7.1 Layer

Temporal volume deficiency can have a variety of causes and can include the underlying bone and the overlying temporal soft tissues, including muscle, fatty layers, and the skin. For treating temporal hollowing, three layers can be considered for placing volumizing filler products: the subdermal plane (right below the temporal skin), the interfascial plane space (the potential space between the superficial and the deep temporal fascia), and the supraperiosteal plane (usually an intramuscular injection into the temporalis muscle). Because the skin of the temporal region is rather thin, any uneven placement of filler below the thin epidermis and dermis complex could be easily noticeable and not easily forgiven (**Figure 3.13**). Filler filled above the bone could be bounded by the temporalis muscle and has been shown to have a reduced surface volume coefficient when compared to subdermal product placement, especially for the softer fillers. The interfascial space has potential to avoid the drawbacks of both the subdermal and the supraperiosteal product placements. Filler in this layer could be used in a more reasonable amount without unevenness (**Figure 3.14**).

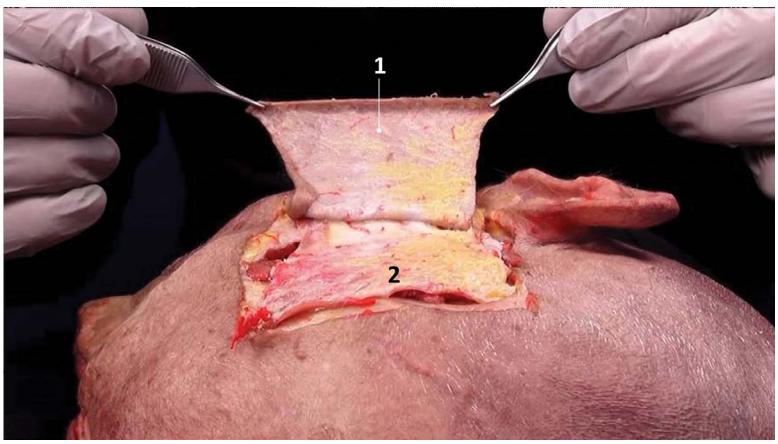

FIGURE 3.13 Cadaveric dissection of the right temporal region. The skin (1) is elevated, revealing the subcutaneous plane. The strong superficial temporal fascia with its superficial and deep lamina contains the superficial temporal artery. (2) Superficial fatty layer on superficial temporal fascia.

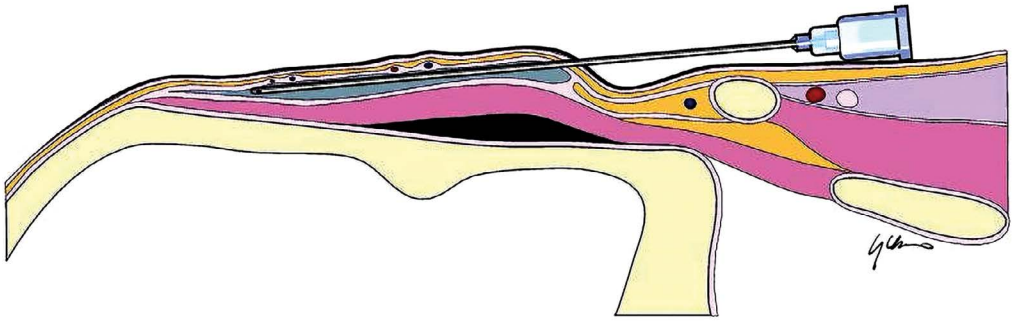

FIGURE 3.14 Interfascial injection is usually undertaken with a cannula, with the entry created above the zygomatic arch and the route between the superficial and the deep temporal fascia.

From an anatomical perspective, the interfascial technique applies soft tissue filler between the superficial and deep temporal fascia in the loose areolar tissue in layer 4. Care must be taken not to place product directly beneath the deep temporal fascia within the deep temporal fat pad, as it is the temporal extension of the buccal fat pad of Bichat located within the midface, which would allow product migration into this region, causing masticatory pain. In addition, a change of plane may puncture the superficial temporal artery located within the superficial temporal fascia. Hence, precise movement and application are required when injecting in this technique.

3.7.2 Instrument

The instrument of choice should be a blunt-tip cannula large enough not to pierce any of the overlying or underlying fascia during advancement. The use of a needle is not recommended due to the presence of the temporal vasculature and especially the change of plane of the middle temporal vein (**Figures 3.15** and **3.16a–c**).

FIGURE 3.15 Belotero Intense is used in this case to fill the temporal hollowness via the interfascial route with a surgical cannula. The guiding fingers help ensure the cannula is in the correct tissue plane.

FIGURE 3.16 (a–c) Forehead, brow ridges, temples, and the cheekbone should be considered as one inter-related unit. In this young male patient, Radiesse is used for forehead and brow augmentation via hydrodissected cannula injection [compare (b) and (a)]. The forehead becomes wider with lateral ridges (a more masculine squared pattern). The cheekbone is augmented by bony depots with Belotero Intense. Without temporal filling, the temporal hood might look more hollow after the augmentation above and below. Belotero Intense is also used for temporal filling via the interfascial technique (see Figure 3.15). Ligaments and septae of the temporal lines – the lateral orbital thickening, the orbicularis oculi retaining ligament, and the zygomatic-cutaneous ligaments (dashed line) – are the boundaries of interfascial filler injection.

3.7.3 Materials

HA fillers are substances with semifluid properties and can be more easily spread through the plane. The interfascial space, though loose in character, has numerous thin fibers intervening in between. With dissecting and multiple penetration of the cannula, this fibrous connection can be broken and the plane can become partially further loosened. Incomplete dissection of the plane could result in uneven distribution of filler. Overfilling with HA could result in a fluctuating gel-like texture and show pitting if pressure is applied (**Figure 3.17**). The filler of calcium hydroxylapatite (CaHA) and polycaprolactone (PCL) could be less fluid in character and more fixed in shape after stabilizing; however, refilling with the same material could become a problem since these biostimulating agents could result in severe fibrotic change and adhesion of the fascia. Reinjection of fillers under adhesion could be riskier as vessels are nearby and could become more fixed. Poly-L-lactic acid (PLLA) liquid could flow down easily in a well-dissected loose space and is not recommended to be used in this way.

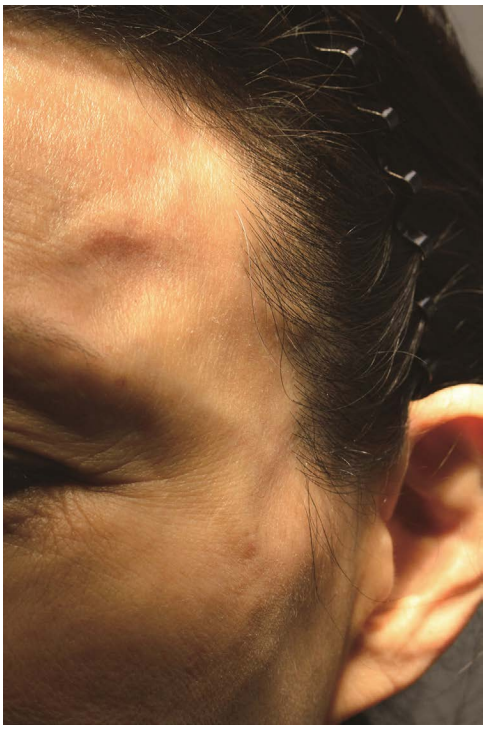

FIGURE 3.17 The drawback of interfascial technique is the creation of a confluent space that increases further the instability of HA fillers inside it. One week after interfacial injection of 1.5-ml HA, fluctuating puffiness can be seen and movement upon pressing and pushing.

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Novel Injection Techniques

4

Yates Yen-Yu Chao and Sebastian Cotofana

Contents

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4.1 INTRODUCTION

With the rapid advances of injectable filler medicine, a filler injection technique has been rapidly evolving to tackle different morphological demands and structural problems. Registered usages, or labeled uses, of a product, usually refer to studies conducted on a bigger scale and data showing clinical effects and safety. However, to date, these indications of labeled use have been rather limited when it comes to covering the entire scope of the morphological and structural problems. Morphology and contour are continuous entities with an aesthetic aspect, while studies focus on only one facet. Most of the techniques described in this chapter were invented and reported by the senior author and other experts in the field of aesthetic medicine. These off-label uses of fillers should be reserved for more advanced users who have mastered the use of needle and cannula and fully understand the properties of products.

4.2 PIXELATED TECHNIQUE

The size and severity of volume deficiency vary from patient to patient and from area to area, so one simple, even infusion of filler does not suffice for all the requirements of correction. Sometimes injection simply bulges the target out, resulting in unsightly shapes. With a 3D printing concept in mind, injectors – or injecting sculptors – should develop for themselves the ability to analyze and differentiate different volume demands in a more digitalized and numerical way. Every point of the deficiency should be graded individually. Filler can then be delivered to those points in a digitalized way with different sizes of aliquot (**Figure 4.1a** and **b**). The many different aliquosts of filler then compose the whole and injection become more versatile, adapting to different contour demands.

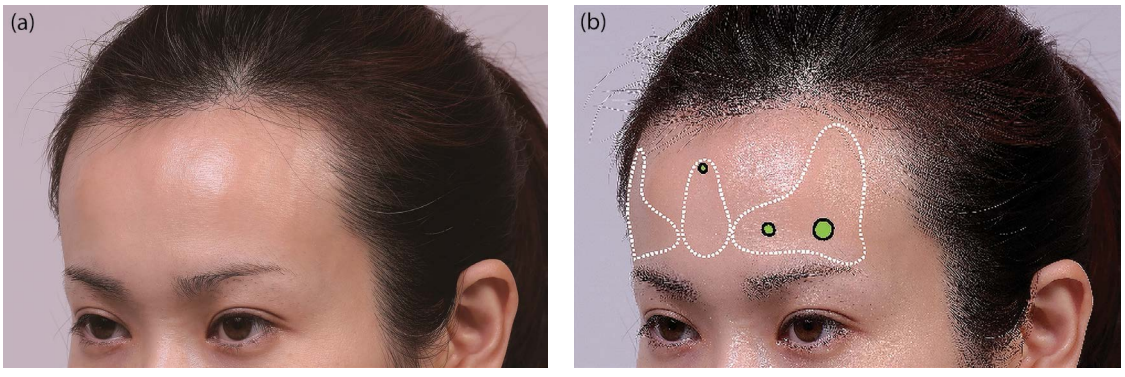

FIGURE 4.1 Volume deficits of the forehead have to been corrected very precisely with different sized aliquots of filler. (a) Dashed white lines on the forehead of this female patient show its contour deficits to be corrected when a smooth convexity is desired. (b) If filler is placed in a digitalized way, and the three deficit zones analyzed as containing many pixel components, then it is easily comprehensible that the margin of the central zone needs only a small droplet, while the central part of the lateral zone needs a bigger drop.

4.2.1 Layer

Because of the precision of the multiple pixel-like depots, this technique can only be administrated by sharp needles. The superficial aspect of the subdermal fatty layer or dermo-subdermal junction has less active vascularity. Deep plane inoculation with needles has been reported using watery fluid poly-L-lactic acid (PLLA) for its benefits of less hydrostatic pressure-driven infusion into vascular structure along the route of injection and easier aspiration check on bone depots.

4.2.2 Aliquot

With PLLA, a quantity per pixel of 0.025 ml to less than 0.2 ml of the suspension should be considered, depending on the volume gaps. For the use of hyaluronic acid (HA) superficially, a trace amount to 0.02 ml of filler with a small particle or soft character can be delivered according to the microscale topography.

4.2.3 Material

This technique was first published using PLLA. Different amounts of PLLA deposited on the frontal supraperiosteal plane eventually induced different amounts of tissue regeneration and resulted in a continuous new contour. For the choices of filler to be used in this technique, substances injected into tissue should be able to change to some degree in shape and distribution upon hand molding to become a confluent volume. It is also paramount for them to be separated by tissue interlacing between the different depots to keep the differential placement and gradient. HA can be used for pixelated augmentation in a superficial or middle layer of subcutaneous tissue.

4.2.4 Indications

Pixelated PLLA is useful for the lateral forehead where there is a broad base of the frontal bone. The digitalized HA technique can be considered for minor contour deficits of the forehead, cheek depressions, grooves, unevenness, and depressed scars.

4.2.5 Advantages and Limitations

A digitalized superficial injection is very flexible for correcting any kind of volume deficiency but only achieves minor changes because of the limited aliquot size. Pixelated correction needs a good sense of 3D volume difference, artistic analysis, and good injection skills. Pixelated PLLA injection on the bone is even more technically challenging because bleeding and needle clogging during the procedure could interfere with the procedure (**Figure 4.2a** and **b**); injectors have to be very quick in escaping from the vessels and expelling clogging, as bleeding could distort the landscape and mislead judgments. Molding is also necessary to merge the different shots. An uneven injection could result in uneven curves; overstacking sometimes results in aggregate nodules.

4.3 HYDRODISSECTION-FACILITATED FILLER INFUSION

Whether injection uses needles or cannulas, the whole procedure of filler injection is the combined action of tissue dissection and filler placement. Instruments have to dissect tissue to accommodate fillers. The connection of tissue especially with fibrotic structures limits the spreading of the filler substance and

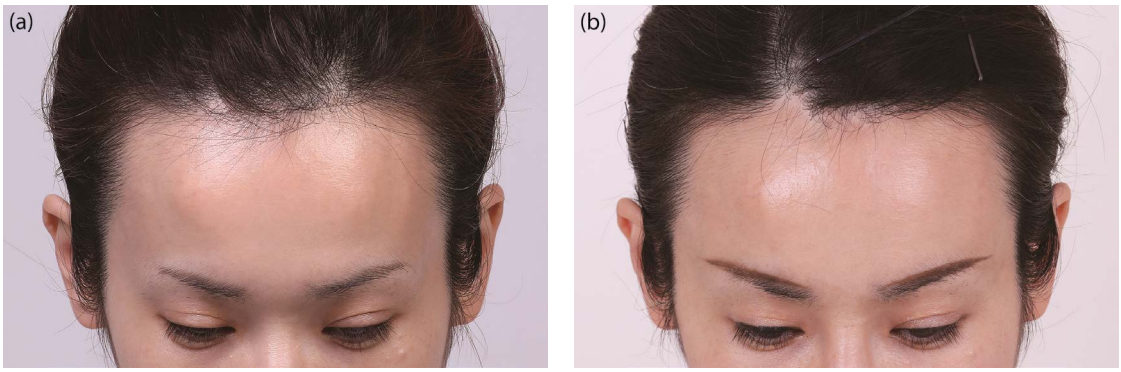

FIGURE 4.2 (a) The same patient of Figure 4.1 received two sections of pixelated needle injection of Sculptra to correct the gaps and curves of the forehead. (b) One year later, neo-tissue growth followed the pattern of how PLLA is placed on the supraperiosteal plane as multiple pixels in different but graded sizes.

prevents the results from being even. That is why augmentation for a larger area needs the instruments to pass through as thoroughly and evenly as possible.

Dissection is the part of the procedure that results in tissue destruction. Unwanted events occur during this step. In some critical parts of the face – the forehead, for example – even the advancement of the cannula by hand is not free of risk. A more rigid cannula sometimes cannot follow the curved surfaces and might change its plane more toward the superficial or deeper layer where vessels or nerves can be encountered. The latter can cause a substantial amount of pain and should be avoided (**Figures 4.3** and **4.4**). However, a flexible cannula can advance more unpredictably into the facial soft tissues, posing an equal risk to the patient. It is not easy to make direct injection on the forehead even, complete and within a single layer. With these concerns, using saline instead of these instruments for the part of dissection is a wise idea (**Figures 4.5** and **4.6a–d**).

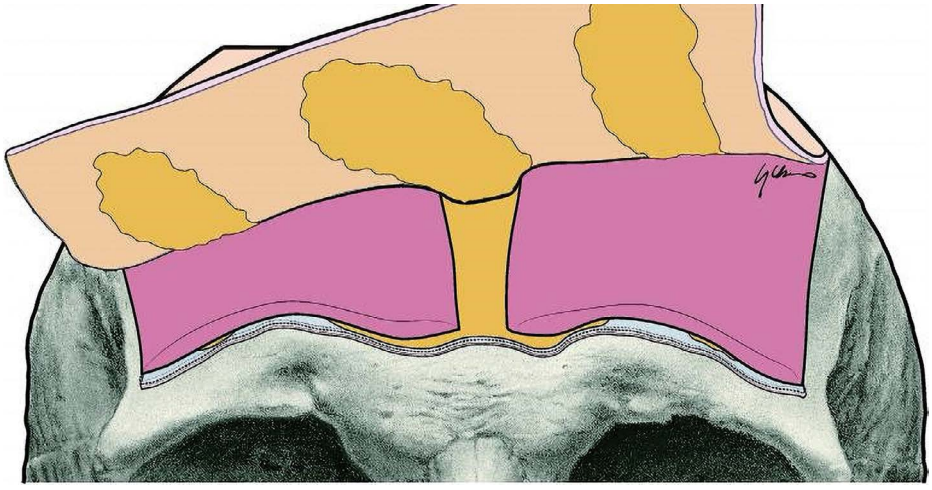

FIGURE 4.3 The forehead structure is unique with a wavy bony base and limited soft tissue space to accommodate injectable fillers. The soft tissue of the forehead from the surface can be divided into epidermis, dermis (pink), superficial fat compartments (yellow above), frontalis muscle (purple), deep fat compartments (yellow below), and periosteum (blue).

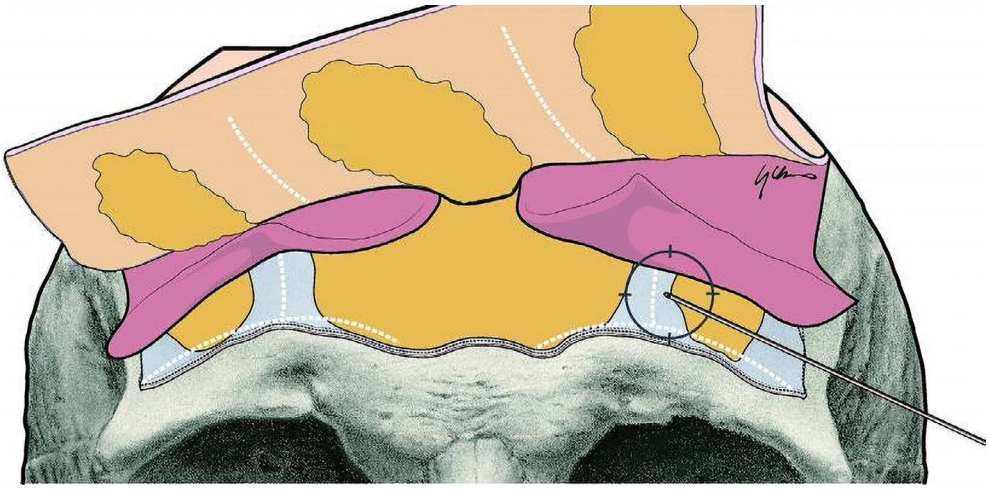

FIGURE 4.4 Injection on the forehead is usually carried out with a blunt cannula and inserted laterally. Advancing the cannula often encounters resistance that comes from the bumps of the wavy bone landscape and the septa between fat compartments. Considering the limited thickness of each layer, the cannula actually penetrates not one single layer but through multiple layers.

4.3.1 Layer

Saline dissection depends on its hydrostatic pressure. Therefore, the procedure has to be performed within a space with a continuous plane that enables the expansion and spread of the liquid. It is also preferable to have a structure with dense tissue as the guiding surface. The supraperiosteal plane above the periosteum (**Figure 4.7a**), the interfascial plane above the deep temporal fascia, and the dorsal superficial lamina at the dorsum of the hands are all feasible environments for the administration of this technique.

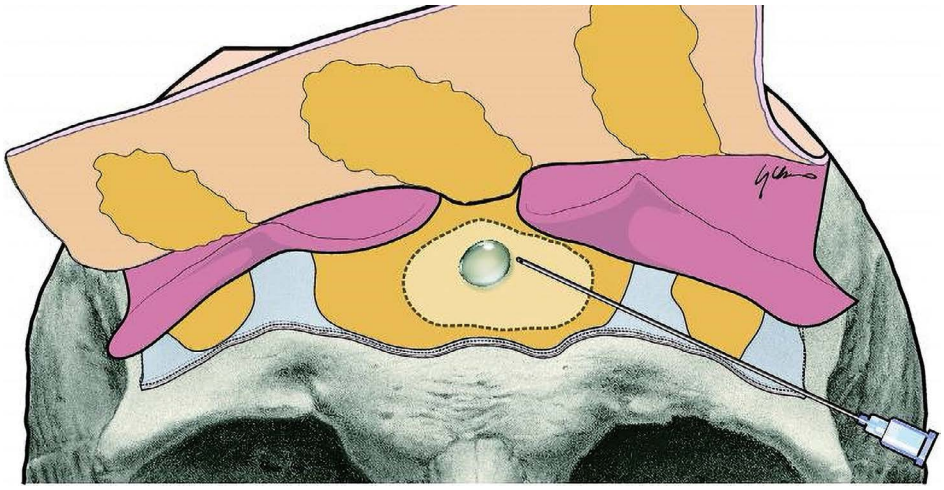

FIGURE 4.5 Saline can be delivered by cannula in bolus. Immediate press on this bolus saline can spread it out and dissect the loose areolar tissue via the hydrostatic pressure that prepares the space for following filler infusion.

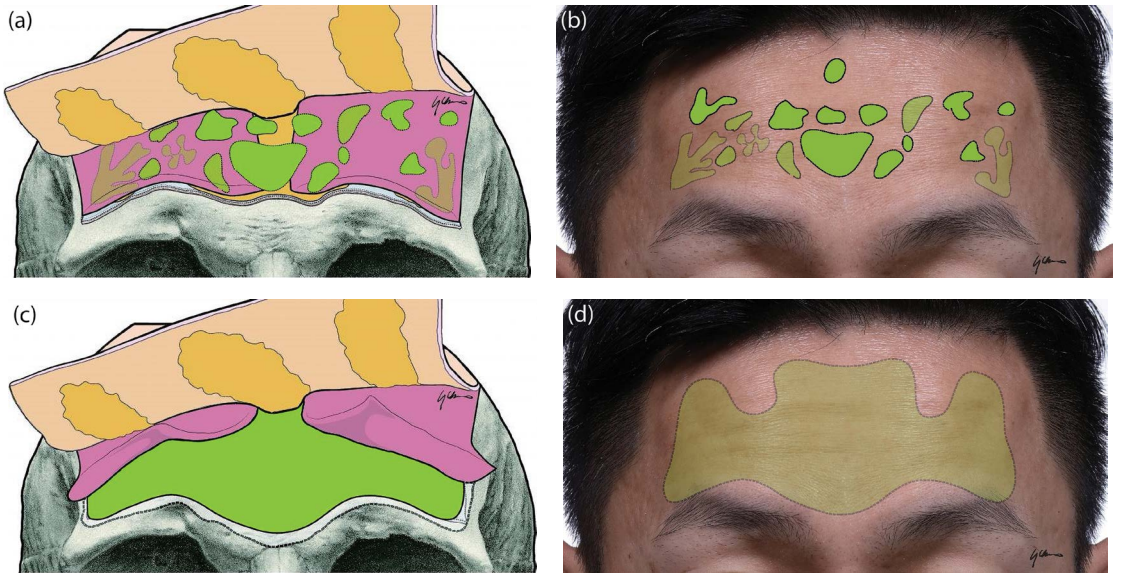

FIGURE 4.6 (a) Direct injection with cannula without hydrodissection is feasible but deploys the filler randomly in a discontinuous phase and not in one layer. (b) That could look acceptable with the masking of overlying skin but is not the ideal technique, when (c) the loose subgaleal space can be well prepared by saline dissection. (d) The whole span of forehead can then be augmented more easily and filled in one continuous phase.

4.3.2 Instrument

Dissection with saline can lessen the need for multiple instrument penetrations. Even for delivery of normal saline by limited passes, needles are not preferred since the purpose is to prevent dangers arising from the instrumentation; a rigid cannula works better than the flexible ones and can reach the point of the target more directly (**Figure 4.7b**).

4.3.3 Dissecting Agent

All fluids compatible with the physiologic environments can be employed because of the lack of harmful effects even if it gets into the vessels during the dissecting procedures. Normal saline and Lactate Ringer are the fluids of choice (**Figure 4.7c**). Agents with local anesthetics inside, such as tumescent agents, should be avoided. Though the space for the following filler infusion has been prepared by these solutions, a cannula that places fillers in the second step could still happen to hit the vessels. Pain is a good and natural protection system that warns the injector when approaching a danger zone.

4.3.4 Material

As the main ingredient of saline and Lactate Ringer is water, the dissecting process with fluids will leave water in the space to be filled with fillers. The present fillers suitable for filling in hydrodissected space are those compatible with water dilution, without losing much of their physical characters and

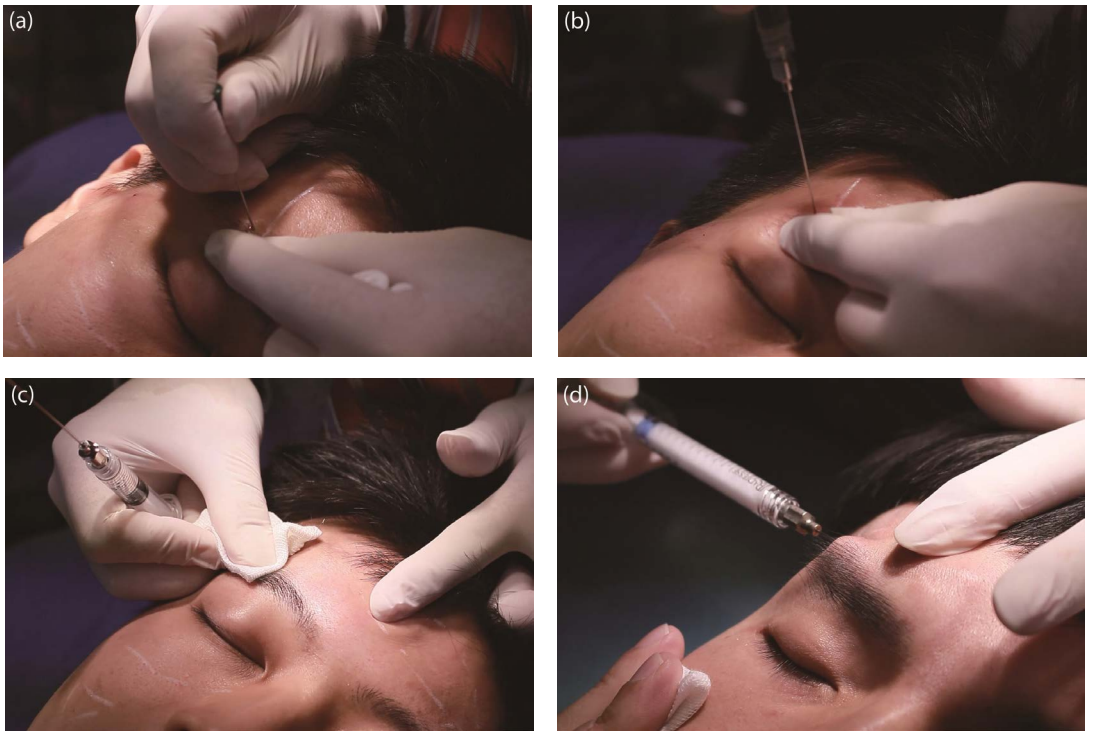

FIGURE 4.7 (a) The entry hole of the cannula should be prepared first at the lateral margin above the brow. (b) A surgical cannula is applied perpendicularly through the entry hole. When it touches the bone, then turn an angle and proceed, adhering to the bone. (c) Dissecting saline is introduced by the rigid cannula in a bolus at ideal spots, then followed with forceful pressing immediately after the deposition. (d) After the whole area is prepared, then infuse the diluted Radiesse according to the volume gap to create the desired forehead shape.

lifting capacity. The author uses the calcium hydroxylapatite (CaHA) product as it is more suitable for these goals (**Figure 4.7d**).

4.3.5 Indications

For forehead augmentation facilitated by saline hydrodissection, correction can be extended to the glabella and lateral borders of the forehead, to be continuous with the temporal curves. The senior author uses this technique to correct various morphological problems of the forehead-glabella complex, including correcting frontal concavity (**Figures 4.8a,b** and **4.9a,b**), camouflaging over-prominence of the supraorbital ridges (**Figure 4.9a** and **b**), creating new feminine bossing, adjusting forehead sloping, contouring the brow ridges, widening the forehead (**Figure 4.9a** and **b**), and so on. The technique can also be applied for the dorsum of the hand to increase the fullness of the dorsal hand surface and for the neck to improve the quality of the skin envelope by a sheet-like layering of fillers spreading along the neck fascia plane.

4.3.6 Advantages and Limitations

With the help of fluid dissection, subsequent infusion with fillers becomes much more effortless. If injectors divide the procedure into the dissection part and the injection part, they could focus more on the

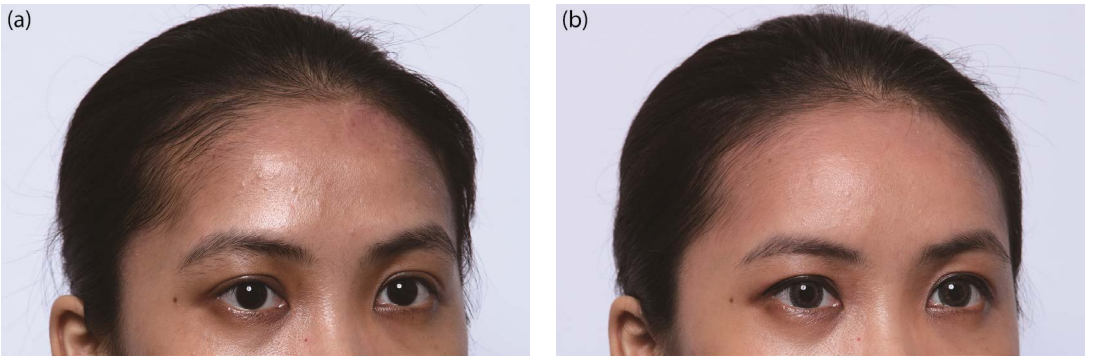

FIGURE 4.8 This young female has suboptimal forehead contours. (a) Augmentation is intended at the lateral, mid-central, and lower central forehead to create better convex transition to the temples and glabella. A quantity of 3 ml of Radiesse premixed with 2 ml of lidocaine is used for the entire forehead after 3 ml saline hydrodissection. (b) Two weeks after the augmentation, the entire upper face is more balanced in fullness and projection, with a smooth transition to the lateral forehead and the brow. The convex curves look more elegant, feminized, and younger.

shapes and evenness of filler distribution without being disturbed by any discomfort and resistance for the patients. The supraperiosteal forehead space that originally is very limited and situated on a wavy and hard bony structure becomes wider and looser. A rigid cannula could travel much more easily in this plane to the desired point. The danger areas become more accessible and injectors could complete a more holistic correction of the whole face without abandoning some important curves like the glabella. It is almost a no-bruise procedure.

Another advantage of this technique is the possibility and easiness of a future retreatment. There is usually fibrosis in the space where filler has been placed previously that makes the second treatment much more difficult and dangerous; this is more true when reinjection is on the forehead and the supraperiosteal plane. Fibrosis hinders the advancement of a cannula in an injection without hydrodissection preparation; hydrodissection with saline releases these adhesions as well.

The limitation of this technique is the learning curve for injectors. Dangers could occur during the first step of tissue dissection or the second step of filler infusion. Novice injectors tend to use more liquid to perform the dissection. When more fluid is used, more swelling is created and the time between dissection and filler infusion should be longer while waiting for the water in tissue to go away. If bleeding

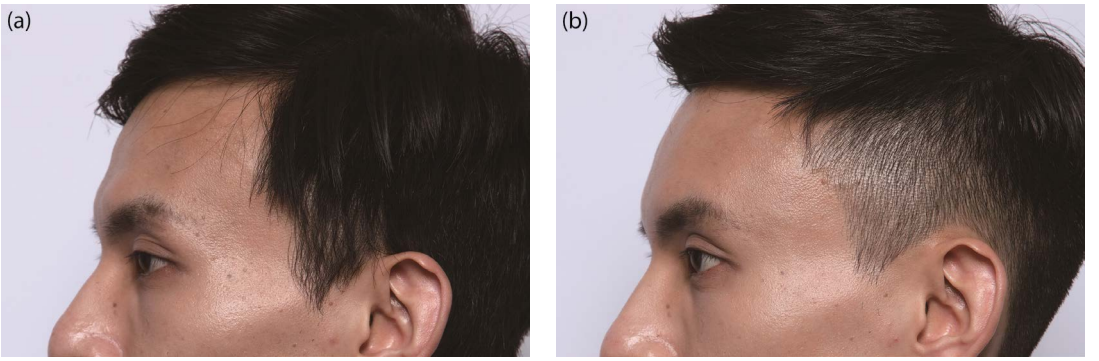

FIGURE 4.9 (a) The forehead of this young male has central concavity, a suboptimal ridge shape, a narrow forehead/brow coupled with severe temporal hollowness, and prominent orbital ridges. (b) A quantity of 3 ml of Radiesse is premixed with 2 ml of lidocaine for the entire forehead after 4 ml of saline hydrodissection. Temples are treated on the same day with interfascial Belotero Intense to balance the new forehead fullness.

occurs during the first step of saline dissection, redness becomes apparent during the infusion process; augmentation should be deferred in that situation.

4.4 SUBCISION COMBINED WITH FILLER INFUSION

Tissue dissection and filler infusion are also separated in some practices by using needles to create spaces for fillers. This technique can be understood as subcision in conjunction with filler injection and it is often indicated for scars and the labiomandibular sulcus (Marionette lines).

4.4.1 Layer

The fibrotic change below tissue atrophy usually extends deep to the superficial fatty layer. Subcision of the scar is a usual practice involving needle disruption of the scarring tissue at a depth compatible with the subcutaneous layer.

Subcision is combined with filler injection in some practices for the deep labiomandibular sulcus. There the muscular and connective tissue fibers adhere to the overlying skin in a vertical line connecting the oral commissure to the mandibular ligament. Disrupting these fascial connections results in an improvement of the marionette lines and a reduction of the visibility of the pre-jowl sulcus. Subcision also creates a space to accommodate filler materials.

4.4.2 Instrument

The subcision procedure can be done with both needles and cannulas. Whereas needles can be better utilized for scars and more distinct adhesions, cannulas can be used for a wider and more large-scale area. However, it should be mentioned that cannula-guided subcision results in an increased amount of bruising, especially if muscle fibers are detached. This should be openly communicated to the patient before the procedure to explain why there will be an increased downtime.

4.4.3 Material

Subcision combined with filler infusion can involve any kinds of fillers but these are usually HA or PLLA. Subcision creates dead spaces that, if polycaprolactone (PCL) or CaHA were used, could result in nodule formation. HA fillers, when mixed with blood and tissue debris after scar subcision, could increase the rate of contamination and biofilm formation because acne scars usually embed in sebaceous-follicular structures and sebum is full of cell debris and bacteria. The space created by subcision could pool HA or PLLA materials. Excessive pooling of fillers is not preferred: pooled HA could feel like an iatrogenic cyst; pooled PLLA will very likely form nodules.

4.4.4 Advantages and Limitations

This is more aggressive and targeted than pure filler injection. It is more responsive and there is more tissue reaction, even when subcision is poorly performed and not effective. The possibility of pooling aggregation and contamination should be kept in mind.

4.5 SUPERFICIAL SCRAPING TECHNIQUE

More and more injectable fillers are marketed as biostimulators that induce tissue reaction and neocollagen formation; CaHA, PCL, and PLLA are the major ones in the market. CaHA used for this purpose is usually specially titrated with different dilutions with lidocaine from 1:1 to 1:6 (CaHA to normal saline or lidocaine). These diluted CaHA agents, when injected into the tissue, will spread more and be more exposed to tissue and have larger contact surfaces and more tissue reaction. The scraping technique is a special superficial layering technique using CaHA to make sure they are deposited in the same plane.

4.5.1 Layer

Scraping of the skin dispenses CaHA just under the dermis. The blunt tip of the cannula could slide more easily in the layer of superficial fatty layer with less resistance and scraping on the undersurface of the dermis that is more dense.

4.5.2 Instrument

A cannula can move in different directions under the skin via a single entry point.

4.5.3 Material

For the scraping technique, the author prefers to use CaHA in a concentration of 1:1 or 1:2, diluted with lidocaine or normal saline.

4.5.4 Indications

Diluted CaHA is delivered under the dermis for biostimulation and structural augmentation. Loose, wrinkled, and weak skin all could benefit from this treatment.

4.5.5 Advantages and Limitations

This is more helpful for patients with distensible loose skin but less effective for severe redundant skin. Asian skin is usually thick and strong and would not be improved through it. This kind of injection technique needs force applied to the cannula with the contact skin as the opponent and the entry hole as the pivotal point. The entry hole could get more tissue damage, inflammation, and consequent post-inflammatory hyperpigmentation. Aggressive and forceful scrapes could break weak skin they encounter.

4.6 3D STRUCTURAL FRAMEWORK

CaHA dilution can temporarily change its physical properties and help arrange its distribution more flexibly. Diluted CaHA becomes less viscous and more transformable and moldable by hand massage. When the mixing water content is resorbed by the tissue, CaHA particles become less mobilized. For a complex

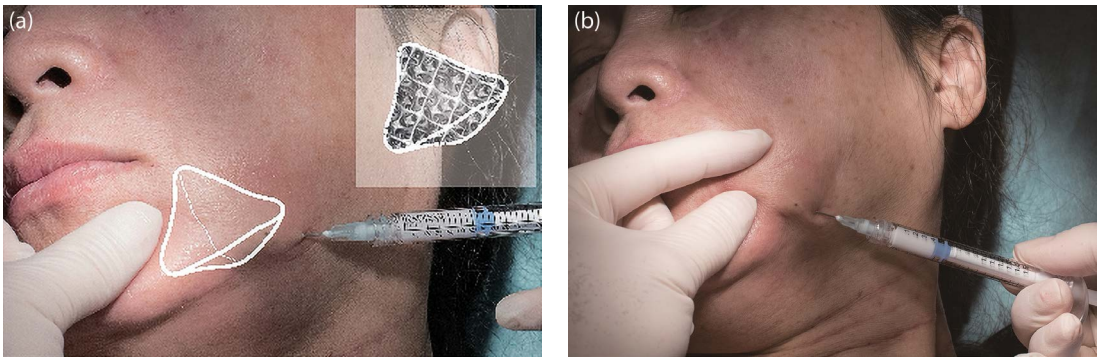

FIGURE 4.10 The volume deficit of the lower face is often more complex more than can be treated by merely a bolus or a fan. (a) If the complex shape is imagined as a 3D-printed framework, injection can follow that shape and be multiplied to build it up. (b) In this middle-aged female, 1.5 ml of Radiesse is premixed with 0.5 ml of lidocaine and used to structure the deficit between the chin and jowl.

shaped volume deficit, CaHA could be applied in a similar way, tailoring it in a distribution pattern to adapt to different contour requirements (**Figure 4.10a** and **b**).

4.6.1 Layer

This 3D pattern augmentation is preferably applied in the superficial fatty layer.

4.6.2 Instrument

The cannula is more appropriate and less worrying for flexible penetration through tissues. However, a needle could also be used in more superficial layers, to a limited extent, or for PLLA suspension liquid.

4.6.3 Material

CaHA is used mainly for the immediate contouring purposes. HA can be applied in a complex spatial arrangement but is less stable. PLLA is possibly delivered in a similar way with fine linear arrangements.

4.6.4 Indications

The mid and lower facial contour can be tuned finely with this technique. Patients who are to be treated with this technique should have enough soft tissue thickness.

4.6.5 Advantages and Limitations

The interstitial placement of diluted CaHA is very flexible for adapting to the volume deficit of different patterns. The injected particles are fixed in situ, widely exposed to tissue, and react with tissue. The replacing volume will move with the body's own tissue under normal mimetic muscle movements, showing good flexibility, and will provide moderate supportive strength (**Figure 4.11a** and **b**). PLLA injected

FIGURE 4.11 (a) and (b) Radiesse is used in this young female for augmentation of the nose and chin. Minimal adjustment of the mid cheek and lower cheek curves is performed by 3D structuring with diluted Radiesse.

in this way could avoid filler particles being gathered together and the complication of nodules. The newly formed collagen-containing tissue is like a penetrating branch that helps fix sagging tissues, which helps more in patients with tissue laxity. Excessive linear fillers on a weak fascia further increase the burden and usually also the descent of the sagging tissue. However, the 3D-patterned filling process is more like a free-style artwork and not easy to be learned. The inexperienced injector with average skills could deliver it randomly in an excessive amount and in poor shape, damaging tissue more.

4.7 INVERTED DEPOT TECHNIQUE

PLLA has been frequently reported to improve acne-scarred skin. The new collagen along with fibrous tissue stimulated by PLLA provides better tissue strength and more volume for atrophied and damaged weak skin. Many acne scar problems are focal only, appearing as focal tissue loss with a depressed pitting appearance. The loss of tissue in acne scars is usually situated relatively superficial. The traditional injection by the depot technique is via vertical punctures or oblique insertion. Some of the reported techniques involve small fanning from a proximal entry. Precision and treatment efficacy are usually limited because the liquid-like PLLA suspension will easily leak from these direct needle holes. The senior author has developed a novel way to deliver the PLLA precisely and in minimal amounts.

4.7.1 Layer

The level of placing PLLA suspension is preferably to be inside the scars or just below them. In practice, the filler is usually delivered to the deep dermis or into the superficial fatty layer.

4.7.2 Instrument

Only needles could deliver the PLLA precisely and superficially as required.

4.7.3 Material

This should be PLLA prepared with normal reconstitution.

4.7.4 Indications

Depression scars with rolling borders are more suitable for this technique. Surgical scars and acne scars with concave contours could also be corrected.

4.7.5 Advantages and Limitations

This technique could limit the lateral spreading of PLLA materials, avoid leaking from a nearby needle hole, and be economical with the product. A needle delivered to the right level will be visible out of the scar (**Figure 4.12**). Injectors performing this technique must be familiar with the control of PLLA flow, acne scar types, and skin thickness. The injection of PLLA for scars should be conservative; large defects injected with a large bolus may result in nodules. The placement of a needle could be a problem because of the constraints of facial structures. For scars with cliff-like borders and in skin showing less extensibility, even injection performed correctly could not help much (**Figure 4.13a** and **b**).

FIGURE 4.12 The inverted injection technique could deliver a precise amount of filler to the superficial scarring plane. Sculptra is used in this male patient to treat the atrophied acne scars via the inverted depot technique.

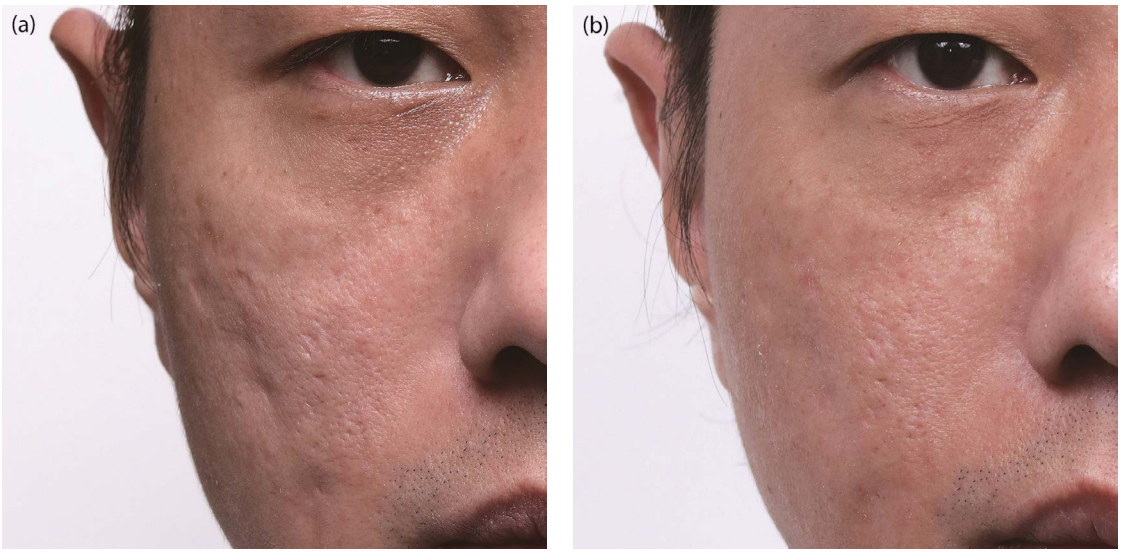

FIGURE 4.13 (a) and (b) The precise deposit of PLLA crystal in the deficient spots of scarred skin results in tissue growth that improves the atrophied volume deficiency.

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Esthetic Filler Injection Pearls

5

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Contents

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5.1 INTRODUCTION

There are many injectable filler workshops, conferences, and anatomy courses around the world every year. Many of the cases used for demonstrations at workshops have been carefully selected, but there are pearls of practice that can make them better pieces of work. Even with the same products in equal amounts, clinical results would look better in some hands than in others. Every form of artwork can have tips and tricks in a technique; injectable filler enhancement should be understood as an artwork as well.

However, work with fillers on a live creature is more than art and skill; it is also medicine. The patient being injected moves and reacts with the fillers. The initial learning process for many injectors is often to mimic something done by the demonstrator, but every subject is different in structure and style. There is no standard protocol, but it is more a case of careful practice and mindful perception. Creative works with fillers are not as flexible as sculpting or painting because the materials for your work are not cheap and the budget is controlled by your patients. You cannot go everywhere freely without concerns for safety. Tips for patient satisfaction, clinical efficacy, and preventing dangers should all be learned to ensure a more peaceful journey.

5.2 PRIORITY

Esthetic medicine is a little different from traditional medicine where what is considered a problem depends on what is understood as standard; however, the standard of beauty can vary from doctor to doctor and from doctor to patient. Usually, the conditions are not critical; the standards vary and the selection of injectables is more or less a matter of commercial consumer behavior. That is why communication between the health-care provider and the patient is extremely important (**Figure 5.1**). Patients usually have preset ideas of what they need. Those ideas may be formed under multiple influences of the media, peers, celebrities, and all kinds of marketing gimmicks. Though they might not be correct, commercial consumer behavior usually considers the one who pays as having the right to decide.

Doctors have to know where the real problems are situated, the underlying structural reasons for them, and how to solve them. To give patients what is not what they are looking for takes a risk they may not appreciate your work; patients in the end usually appreciate improvements in the right direction but

FIGURE 5.1 Photonumeric systems are often used as a communicating tool between clinical practitioners and between the doctor and patients. However, most of them just provide a form of description focusing on certain parts of our body; the change in real human bodies, for example, the nasolabial fold, will be more complex and a dynamic process involving the neighboring structure, texture, volume, and position. Some morphological spectrums are more complex than a linear relationship and not easy to describe using these systems that have a one-dimension scale. (Scale by courtesy of Merz Aesthetics.)

FIGURE 5.2 Patients may request treatment following what they have heard about in the media but without correct understanding of what is involved. The tear trough and nasolabial fold are often the targets of patients who have heard about injectable treatment but have no ideas about their actual problems. Doctors have to analyze the individual patient in morphological and structural terms, pointing out the priority between these, and reach an agreement with the patient. (a) The curve of cheek appears saggy because of the bony structure and fat distribution, not tissue laxity. The priority problem to be solved is the profile and the cheek curve adjustment, not adding more volume to the relative protruding maxilla and the well infraorbital region. (b) Juvederm Voluma is used in this case to augment the chin and medial upper cheeks. The new volume balanced the relationship of maxilla to mandible and corrected the saggy curve. Juvederm Volift is used to augment the forehead and the nasal dorsum. The profile becomes more vertically oriented and landmarks of the profile projection are better posited after the injection.

they will question the results according to what they wanted. Injectors have to discuss with and educate the patients but have to respect what is agreed with the patient rather than merely impose what they believe (**Figure 5.2a** and **b**).

5.3 COST-EFFECTIVENESS

There are often presentations at esthetic medical conferences elaborating on achieving the best work with the least amount of filler. Cost-effectiveness is an important issue because the cost of every injection is usually relatively high. These non-critical treatment expenditures are usually regarded as investments, and return on these will certainly be examined.

Patients may care about their appearance but have only a certain amount of budget; if an initial trial of these esthetic treatments up to the financial limit they had set gives only very limited improvement, dissatisfaction will hinder them pursuing their aims further. If the patient has experience in being treated

FIGURE 5.3 Younger generations are more willing to accept adjustments from injectables but can usually have a limited budget. Injectable fillers have to be wisely chosen to address the most important issue and give good cost-effectiveness. (a) This young male has a rhomboid facial shape that is not ideal for males. The sunken appearance of the cheeks and temples urgently need correction to look healthy. Radiesse is chosen in this subject to augment the forehead, chin and jawline for a broader upper face and a more oval to rectangular configuration. Belotero Intense is used to fill the concave shapes but has been done in moderation. Belotero Balance has been adopted to smooth the minor uneven surface. (b) The after photograph displays young male vibrancy and juvenile masculinity.

by different injectors and with a similar amount of substance, they would certainly be more satisfied with the one that made most improvement and would be more inclined to return to that doctor (**Figure 5.3a** and **b**).

5.3.1 Layer Considerations

Soft tissue filler injections result in different skin surface effects, depending on the volume injected and the characteristics of the product used, i.e., its water binding capacity, tissue integration, migration, and resistance to deformation. Moreover, the fascial plane of injection and the fat compartment targeted strongly influence the surface projection achieved. If the same amount of one hyaluronic acid (HA) filler is to be placed under the skin to give effect, without doubt, the superficially placed HA will be more visible than the deep-seated one.

The concept of the surface-volume coefficient was recently introduced as a measure to calculate the facial region-specific effect by measuring the clinical effectiveness of an injected material. It is calculated by dividing the absolute change in surface projection (cm^3) in scanned three-dimensional (3D) images by the amount of volume injected (cm^3). A recent study evaluated the change in surface projection in relation to the volume of soft tissue filler injected for various superficial and deep facial fat compartments using 3D surface volumetric scanning. The results have significant clinical implications, since injectors would like to aim for efficient product placement, using the least product possible to achieve a maximum effect,

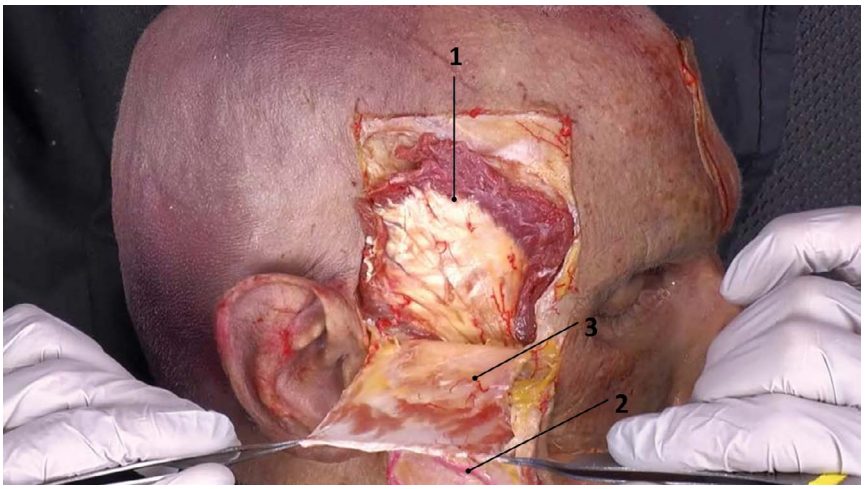

FIGURE 5.4 Cadaveric dissection of the right temporal region, revealing the temporalis muscle (1) beneath the deep temporal fascia. The superficial temporal artery (2) can be found enveloped between the two laminae of the superficial temporal fascia. (3) Deep temporal fascia (superficial lamina, superficial temporal fat pad, deep lamina).

as the volume to be injected is often limited by the patient's budget. Knowledge of the underlying anatomy allows for most efficient, effective, and safe product placement, tailored to the individual patient's needs. Of the fat compartments investigated, the study revealed the highest surface-volume coefficient for the suborbicularis oculi fat compartment (0.94), followed by the superficial lateral forehead compartment (0.74), the deep lateral forehead compartment (0.68), the deep temporal fat pad (0.64), and the deep medial cheek fat compartment (0.29).

Furthermore, a study investigated the surface-volume effect of different techniques for soft tissue filler application in the temple, including subdermal, interfascial, and supraperiosteal (intramuscular) injections. Placement of soft tissue filler supraperiostally for volumization in patients with moderate-to-severe volume loss of the anterior temple and visibility of the temporal crest requires a relatively high amount of product, as all the layers lying above need to be lifted by the product (**Figure 5.4**). Less product is required with subdermal injections, which places the product within the superficial fatty layer. Cadaveric and clinical studies have shown that the surface-volume coefficient is higher for subdermal injections, showing that the injection volume required to reach the same surface effect is smaller for superficial as compared to deep injections. However, in patients with severe volume loss of the anterior temple this technique of superficial product placement can be limited due to the potential visibility of the product, especially if a strong filler is used with a high G′ and G″.

5.3.2 Rheological Considerations

If different types of HA fillers are to be placed under the skin to give effect, the one with better lifting capacity would lift the overlying skin and achieve a more effective result. Fillers that have higher elasticity usually are better at lifting; fillers with higher viscosity and less creeping tendency will stay where they are injected and will give a more precise effect – in other words, they will be more cost-effective. Filler of the same character but in larger particles is fixed better by the tissue and will also be more lifting effective. Filler with higher cohesivity will maintain the original conformation better under pressure and will have more long-term effects (**Figure 5.5a** and **b**).

Importantly, the G′ and G″ of a product are significantly related to their extrusion force during injection, with higher G′ and G″ products requiring higher extrusion forces.

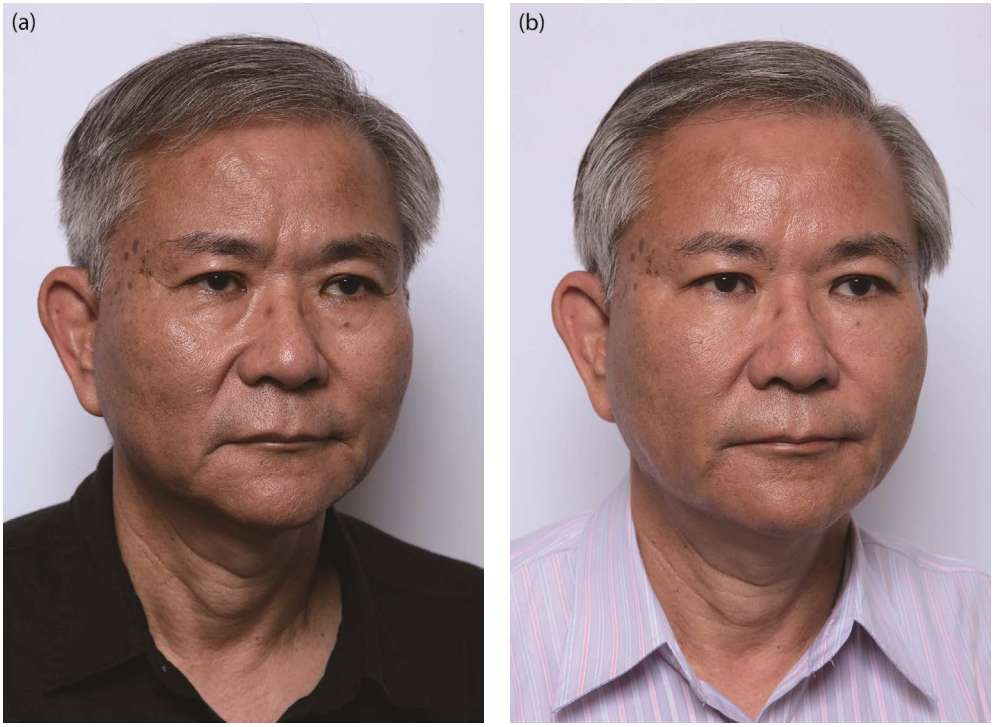

FIGURE 5.5 Older males are often treated badly when their injectors adopt the regimen no different from that for females, so the patients look unnaturally like grandmothers after the treatments. Asians usually retain their skin thickness and fat contents even with prominent aging symptoms of wrinkles, volume imbalance, and sagging curves. (a) Radiesse is used in this male to augment the chin and jawline. It is the filler strong enough to provide support for heavy descending soft tissues. Radiesse is also used in the saline-facilitated technique for forehead and brow augmentation to change a heavy sagging configuration and give masculine definition. Cohesive Belotero Intense provides supportive volume in relatively deficient areas with good tissue integration. Belotero Balance is used to fill the lines and gaps that are the major component of looking old in this face. (b) The after photograph does not look artificial or feminized but more refreshed and balanced in facial volume.

5.3.3 Longevity Considerations

Most modern legally approved filling substances are temporary fillers. That means the results of filler augmentation will disappear after a certain period. The longevity of a filler correlates to how often patients need to repeat a similar procedure. Patients, of course, care about the expiry date of such expenditures. If other conditions are the same, fillers with better longevity show better cost-effectiveness. Some fillers are modified in structure to prolong clinical effects, but changes of structure sometimes also change the behavior of fillers and the tissue response. Nodules and granuloma were reported as occurring more in similar products of the longer versions. In the same way, the permanent filler does not mean that it is good value. Permanent fillers will stay in the tissue unless removed surgically. In clinical practice, these permanent foreign substances are not easy to remove clearly even by open surgery. Tissues will age and the conditions and relative tissue positions will change. Some permanent materials have resulted in severe problems in the past, while some new permanent fillers are being marketed. The safety of the new permanent fillers should be carefully monitored to ease public concerns.

5.3.4 Visual Considerations

On first meeting, people tend to look into the eyes of the people with whom they have contact. Our gaze has preferential targets when it alights on a human face. The more noticeable changes will be interpreted as more effective when a fine touch is placed around these areas. That means some of the facial correction we carry out will be more low-key improvement, while some of the works can be more obvious. These obvious areas include the tear trough, nasal dorsum, and chin. Localized correction of these "more important" areas should be done cautiously because work could have more effects here than elsewhere and can probably also be too prominent (**Figure 5.6a** and **b**).

5.3.5 Tenting Effect

The insertion of a filler substance in tissue is intended to replace volume deficiency or to add what is inherently lacking. However, what we see from the outside of the surface skin is the complex stacking effect of different tissues together with the filling substance. Fillers filled in a continuous mode or at an interval could have effects that look similar. The tenting technique is usually applied to grooves and linear-form depressions to give support; it is also the technique that is used to achieve clinical effects when there is only a limited amount of injection available.

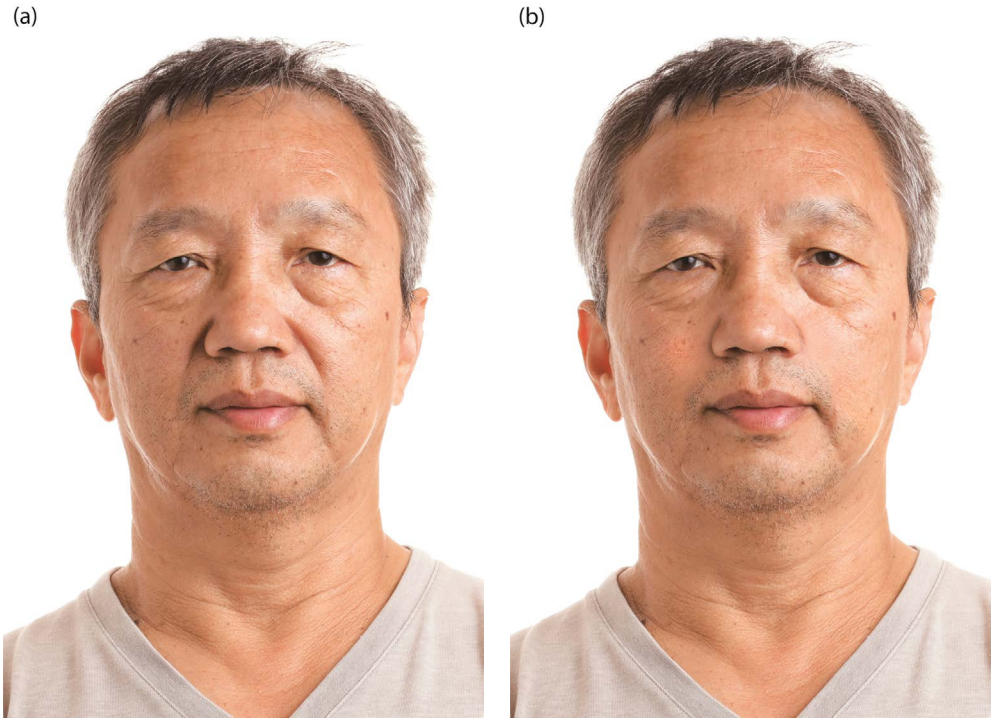

FIGURE 5.6 Visual appropriateness is important. Our brain will discriminate against inappropriate appearance as unnatural. (a) Aging signs are the normal progress of facial changes that should be distinguished from those factors that oppose what we consider as beauty, like balance, moderation, and good proportion. Aging changes are not wrong at a certain age but could be manipulated to be lessened, mimicking the look of a younger age. (b) This is certainly wrong when presented in a noncoherent way. Fillers are often used for targeting certain grooves or curves but neglecting the whole picture. The nasolabial fold has here been removed using graphic software, but the after photograph looks strange (not younger or better) after the disappearance of a normal landmark.

5.4 CULTURE AND CONCEPT OF BEAUTY

Great work done in an inappropriate subject could cause distress. Appropriateness is an art where injectors have to design and carry out treatments for patients according to their different qualities and concerns.

5.4.1 Consultation and Communication

During the very limited time that doctors have to interact with patients, doctors have to figure out exactly what patients are concerned about and ideally appreciate the relevant background of the patients, in order to provide the right regime. Communication skills are beyond the scope of this book: patients' clothing, the style of talking and vocabulary used in communication, body language, and manners all reflect the level of education, socioeconomic status, ethnicity, family background, and possible occupation.

5.4.2 Reading of Characters

From patients discussions, we can learn approximately their attitude toward facial enhancement and the aggressiveness and the magnitude they can accept with appearance changes.

5.4.3 Socioeconomic Considerations

Socioeconomic status influences not only the pattern of a patient's preferences but also the number of affordable expenses. Many public figures worry about downtime and over-prominent changes. Patients from fashionable industries usually are very sensitive to minimal changes, have more demands, and are more positive toward good visible improvement. Patients with professional jobs usually request gentle and low-key improvements rather than the absolute best possible version.

5.4.4 Family Culture and Peer Pressure

Many patients who ask for treatments want to please their partner or are under pressure from their peers or family; and it is even more the case that patients limit the extent of change according to the standards of their family, their culture, religious reasons, or peer pressure. We always have motivations and dreams in our own hearts but we also care what other people think. Doctors have to care about what the patient cares about (**Figure 5.7a** and **b**).

5.4.5 Motivation for Treatments

The most complex thing when treating patients with esthetic procedures is patients who trade their physical appearance for some psychological demands. Obsessiveness stemming from low self-esteem, shame from physical or emotional trauma, or hatred from abandonment or betrayal all empower the endless pursuit of treatments. However, what these patients need is psychological and mental treatment/support rather than physical alteration or intervention.

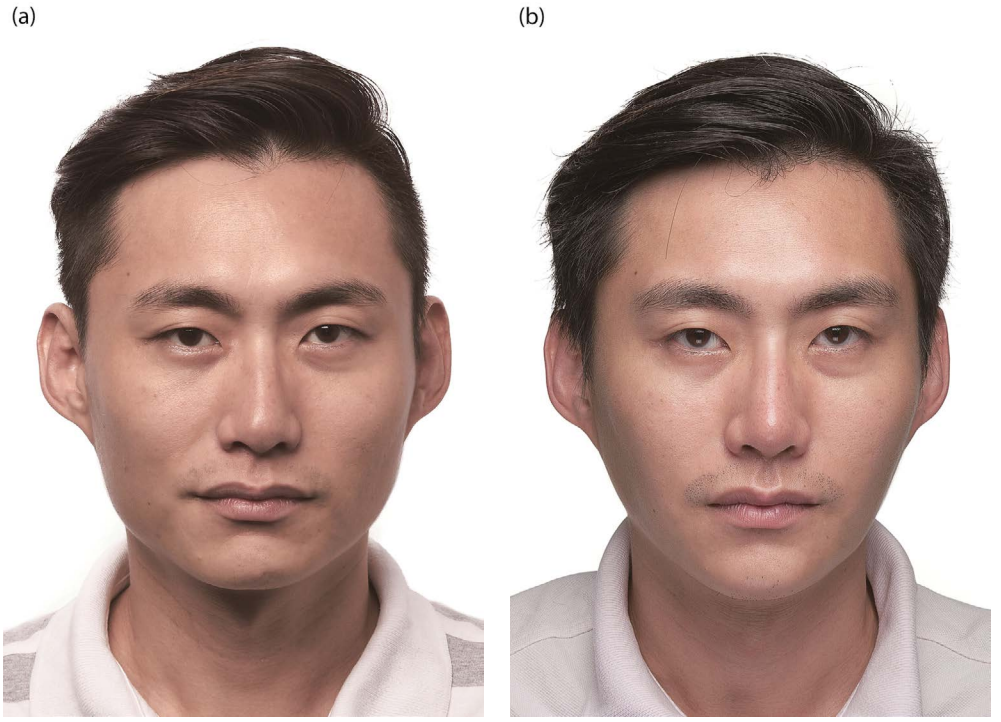

FIGURE 5.7 The strategy for patients of different racial structural features and culture backgrounds should be different. What is considered attractive in an Asian population is very different to that in Western cultures; it reflects different original structural conditions and different stereotypes of the ideal. (a) This Singaporean male has features of a wide cheekbone and wide mandible. The facial shape is square with relative strong bony ridges on the jaw but relatively weak and soft upper facial contours. The problems of an opposite upper-to-lower ratio and a wide configuration take priority over masculine bony shapes. Restylane Lyft is used to correct the nasal deviation and change the cheekbone projection. Restylane Defyne is injected on the eyebrow area to balance the lower face, prolong the chin, and correct the facial asymmetry. Toxin is applied on the masseter to slim the lower face. Restylane Volyme is used to adjust the cheek curves. (b) The wide and flat format and square shape has been corrected after the injection and fits better with the patient's temperament and entire physique.

5.5 PATHOGNOMONIC TREATMENT VS MORPHOLOGICAL CORRECTION

Various studies have been devoted to finding evidence of volume changes behind apparent morphological problems to support the use of fillers and the best way to deploy foreign materials for improvements. What is lacking and what is lost have long been regarded as the scientific basis for filler replacement. However, it is important to keep in mind that what we add in is not necessarily the same as what we need. When the loss of fat is replaced with HA, HA particles behave differently from the interlinked fat globules and fat septum. A successful soft tissue filler treatment restores or improves the contour, the relation, and the movement of tissue structures and makes them behave like the real thing (and even better than that, in the optimum result). Replicating what anatomy or pathognomonic ideas dictate should be there could mislead injectors and produce results different from what you wanted.

5.6 VOLUMIZING VS LIFTING

There has been a recent trend to use soft tissue fillers for their lifting capacities (besides their volumizing capacities) after increasing scientific evidence has provided convincing arguments. Different injection techniques have been developed based on increased understanding of the functional anatomy of the face. However, careful patient selection has to be implemented in order to achieve the desired outcome.

5.6.1 Aging and Sagging

In the development of the field of antiaging and rejuvenation medicine, gravity and laxity had long been considered the main reasons for an aging appearance. The procedures of facelift through tissue trimming, plication, relocation, and fixation all conditioned laypeople and even professional practitioners in the logic of moving tissue upward as a so-called lift. With the emergence of injectable fillers and increased understanding about the evolution of facial volume, history has swung from the aim of trimming to the opposite aim of filling. Twenty years after the development of injectable fillers – and much longer after the initial invention of surgical lifting procedures – a conclusive and fair review would find that simple reliance on one extreme of the concepts of aging treatment would end in unnatural results. Aging is a complex multifactorial process that includes all structures of the face and has a different onset and a different pace depending on age, gender, and ethnic background.

5.6.2 Rejuvenation and Lifting

If we understand the aging process correctly, we realize that the health-care provider should understand and address age-related changes based on their pathophysiology and not on their symptomology. The definition of "lifting" would be very interesting when talking about the treatment effects of all kinds of methods. When fillers are marketed for lifting, we have to make sure patients understand it correctly, as do the medical practitioners who provide the services and ensure whether it is a scientific change or just a morphologic description (Section 3.6).

5.6.3 Structural Lifting and Morphological Lifting

When lifting happens in tissue structures, the saggy tissue-independent part should be relocated to a place higher than in the descended condition. By definition, lifting means motion against gravity. Traditional surgical lifting involves dissection, redraping/dislocation, and fixation. However, injection procedures do not involve any separation, dislocation, or fixation of tissue. Volume augmented upon supportive structures like cheekbones or brow ridges would have buttressing functions that pull the whole soft tissue envelop up a little. Morphological changes from the mere "padding" of tissue usually are limited (Figure 3.11c). Some of the appearance changes we interpret as lifting come from the disappearance of shadows, depressive curves, and redundant bulging (Figure 3.11d). Filler augmentation could also create the visual effect of facial inversion with a bigger upper part and smaller lower part to achieve a lifted configuration. Sometimes the claimed lifting effect comes from what fills the gaps and depressions mimicking the flatness associated with lifting and from what pulls the skin from both above and below augmenting the supportive structures.

In conclusion, aging and sagging is a complex process that is only partially related to the structural volume that can be corrected with fillers but can be improved more in morphology by fillers through indirect camouflaging.

5.6.4 Points for Supporting

Only if fillers are augmented against a rigid/supportive structure would the increase in volume have a buttressing function. For the human face in an upright posture, the whole forehead, brow ridge, temples, and cheekbones could all provide supportive bases. Injection on the chin, jawline, and infra-auricular/retromandibular area could pull down and stretch the skin (Figure 3.11d).

5.6.5 Points for Filling

After lifting injection, the concave curves due to tissue sagging should diminish or disappear. Gap filling is an important component contributing to a "lifted" appearance. Supraorbital sunken grooves, infraorbital hollowness, cheek depression, nasolabial folds, marionette line, and mouth angle depression could all be addressed to give a corrected appearance. Temples, premaxillary space, and medial cheek fullness could all be inflated to disguise a proper upper-to-lower lifted proportion. Nasal spine, pre-jowl sulcus, and post-jowl insufficiency could also be augmented to camouflage saggy and droopy contours.

5.7 THE IMPORTANCE OF MOLDING

Adjustment during and after injection is equally important as the injection of fillers itself.

5.7.1 Impact of Molding on Fillers

Correct molding could correct minor faults made during the injecting process. Molding could facilitate the spreading of filler in tissue and the integration with self-structure, give a smoother transition and correct shape, and promote tissue reaction.

5.7.1.1 HA fillers

HA filler substance exists as a gel-form polysaccharide aggregation. It flows as a semisolid fluid in a syringe and through the needle with resilience as every particle of the HA gel is much bigger than the needle diameter. After entering into the tissue, the distribution pattern will vary because of different physical properties. Needle or cannula delivery is the first step in HA particle distribution, while the molding helps further integration of and distribution of HA particles in tissues. Softer gel HA usually is intended for more tissue permeation and integration, while stiffer and granular HA is more targeted in placement. Needle or cannula deployment of HA is usually limited in spatial coverage but molding of the tissue/filler complex after injection could push the filler substance further into intercellular or tissue matrix spaces for more integration with a more even distribution in tissue.

That kind of redistribution is beneficial for the stability of filler substance in tissue. Through weak affinity between filling substance and tissue molecules, HA filler could stay and move together with a tissue when muscle contracts, pulling or squeezing the complex.

To create a ridge, prominence, and projecting contour, molding can be applied to modify the magnitude of projection and the pattern of marginal transition.

5.7.1.2 Calcium hydroxylapatite

Calcium hydroxylapatite is usually injected with a different titration of normal saline or lidocaine. When the product of CaHA is injected in the original form with or without lidocaine, the elasticity and viscosity are much higher than the usual HA products. The high elasticity of CaHA endows it with better lifting capacity, while the high viscosity limits its spreading in tissue. That could be a hindrance to even distribution or a barrier (in that injectors have to deliver it more delicately to get it an even result). For targeted tissue augmentation, molding can be applied to adjust the magnitude of projection and smoothness of lateral transition through limited lateral spreading (**Figure 5.8**). When CaHA is intended for zonal augmentation, dilution with lidocaine is preferred to get a thinner mixture and more even tissue distribution. Molding of tissue after injection becomes much more important in the recent trend of hyperdiluted CaHA. Hyperdiluted CaHA is usually applied to an area of soft tissue or skin for wider coverage and more tissue interaction. The lateral spreading of the diluted mixture could compensate for the limited linear passage of needles or cannula.

5.7.1.3 Poly-L-lactic acid

Massage is an important part of the treatment process with injectable poly-L-lactic acid (PLLA). The liquid nature of PLLA suspension in a syringe and tissue differs a lot from other injectable fillers. Massage after injection – especially immediately after – helps the redistribution of PLLA particles suspended in the watery solution. Water will not stay for long in tissues after injection; it will be reabsorbed by tissue very soon. PLLA injection is a procedure that should preferably proceed quickly (**Figure 5.9**). If the

FIGURE 5.8 Saline-facilitated forehead injection using diluted CaHA can deploy the filling substance in the whole forehead as a continuous plane. The retained elasticity and better viscosity on resorption of the mixing water enable the injector to mold it into the desired shape. The molding is more like a clay casting job. Finger tactile sensation is equally important as visual detection for any asymmetry and unevenness.

FIGURE 5.9 The standard protocol for PLLA injection also includes postinjection massages for several days. The massage after injection aids the merging of injected PLLA liquid with the tissue and redistribution of the fluid; this massage should be applied as soon as possible, depending on the purposes of modification.

whole process of PLLA injection has been delayed, the massage after injection might have already lost its intended function of filler redistribution. Inadequate spreading of particles and overconcentrated gathering of PLLA solution in tissue could be the reason for nodule formation.

5.7.2 Molding during Procedures

The guiding finger could play an important role in successful injection work. The volume change detected by palpation reflects the situation more precisely than what is visible. And the guiding finger can adjust the shape and distribution immediately upon any deposit of filler substance. The moment immediately after each injection is the best time for the injector to evaluate the effect. As the physical property and composition of some reconstituted injecting materials could change with time, molding during the procedure should be emphasized (**Figure 5.10**).

5.7.3 Molding Immediately after Procedures

On most circumstances, molding occurs immediately after the procedure. However, the swelling from injection tissue trauma and inflation due to hemorrhage are also present at this stage. Injectors who mold the tissue/filler complex to change the extent and pattern of filler distribution should bear these factors in mind. For example, the cheekbone of the left side after augmentation can look higher than the right side because more hemorrhage occurred during the injecting process on the left side. After injection, the injector wants to balance the bilateral prominences by molding and pressing the left side more. The filler that

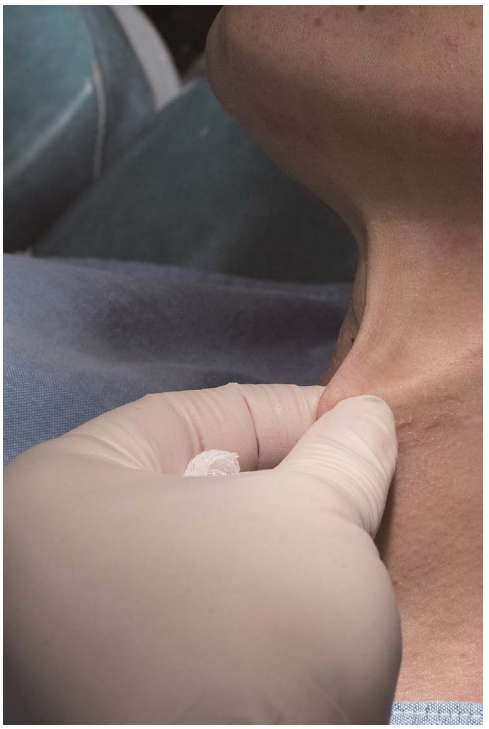

FIGURE 5.10 For some techniques, molding immediately after injection is part of the skill. Neckline injection usually requires precise dosing and appropriate layering. HA injection for the necklines is similar to the blanching technique and requires postinjection massage to facilitate tissue integration. The injection technique for diluted CaHA on necklines has to rely on immediate massage to redistribute the small and temporarily thinned filler material. If massage is delayed and the mixture dissipates after the water content is reabsorbed, CaHA may appear uneven or bumpy under thin skin.

was filled in the left side spreads more. After resolution of the hematoma one to 2 weeks after, the left side cheekbone could look blunt and less projecting compared to the right side.

5.7.4 Molding Days after Procedures

When the tissues receiving filler dry, fillers usually become reluctant to move or to be deformed; that occurs when the injecting material is CaHA or PCL. PLLA is introduced into the tissue by the carrier of limited carboxymethylcellulose (CMC) and water and appears more fixed in location days after the water carrier is gone. Gel-like substances like HA gradually merge with a tissue after repeated muscle movements; delayed molding when patients come back is mandatory to achieve the best results.

5.7.5 Tips for Molding

For adjusting the shape in contouring injections, molding should be applied direct to the side intended to be reduced. Molding force should be adapted to the consistency of the fillers and be as gentle as possible. Molding to enhance filler distribution should be more aggressive and immediate. Forces should be applied to where there is an excess.

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6 Adapting Injection Techniques to Different Regions

Yates Yen-Yu Chao, Sebastian Cotofana, and Nicholas Moellhoff

Contents

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In this chapter, fillers of different entities will be introduced for their selection, indication, and techniques, according to different anatomical regions.

6.1 FOREHEAD

The forehead accounts for almost one-third of the face in size; however, the use of fillers for enhancement of the forehead does not command a similar percentage. The reason for being left behind probably can be attributed to challenges in technique for injecting fillers here and concerns about the danger of vascular injury. Forehead beauty is extremely important. It is one of the body areas that shows the most gender traits, and its shape and dimension expose the age and brain size of the subject (**Figure 6.1**). A beautiful looking face should have an ideal forehead to match the mid- and lower face and to complete the ideal facial shape as the upper portion.

6.1.1 Overview of the Anatomy

The forehead is bounded superiorly by the hairline and laterally by the temporal crest. Inferiorly, it extends to the eyebrow and glabella region, bordered by the superior orbital rim. Its layered arrangement is an extension of the five layers of the scalp and includes skin (layer 1), superficial frontal fat compartments (superficial central and the two superficial lateral forehead compartments; layer 2), supra-frontalis fascia (layer 3), the frontalis muscle (layer 4), retro-frontalis fat (layer 5), subfrontalis fascia (layer 6), pre-periosteal fat and deep fat compartments (layer 7), as well as periosteum (layer 8). The retro-frontalis fat is continuous with the pre-septal and retro-orbicularis oculi fat (ROOF) and contains the deep branches of the supraorbital and supratrochlear neurovasculature in the lower forehead, before they change plane and travel above the frontalis muscle after passing the middle frontal septum (**Figures 6.2** and **6.3**). The superficial branches of the supraorbital and supratrochlear arteries travel between layers 3 and 4 just after their emergence from the bone. It is noteworthy that the deep lateral branch of the supraorbital nerve travels within the periosteum and has fibrous connections to the subfrontalis fascia, marking the lateral boundary of the deep forehead compartments. Motor branches supplying the frontalis muscle course beneath the muscle and are protected from the supraperiosteal plane by the subfrontalis fascia. The

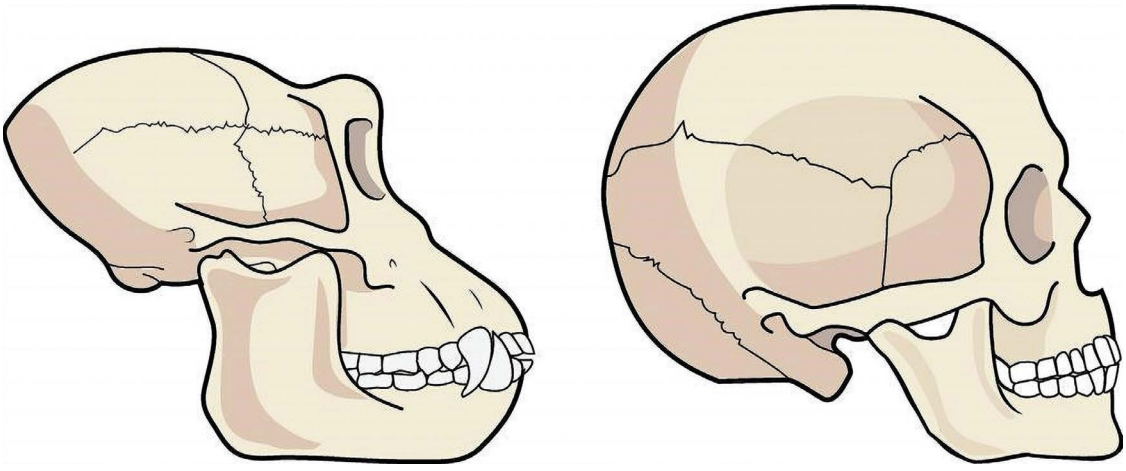

FIGURE 6.1 The studies on brain size of primitive specimens and the ancient species have relied on estimations of the internal dimension of the skull. The species of the Lucy fossil, *Australopithecus afarensis*, had skulls with internal volume about 400–550 ml, the chimpanzee about 400 ml, and gorillas between 500 and 700 ml, whereas present human beings have an average size about 600 ml. Brain size can be reflected in the external skull shape and size and also in the forehead configuration.

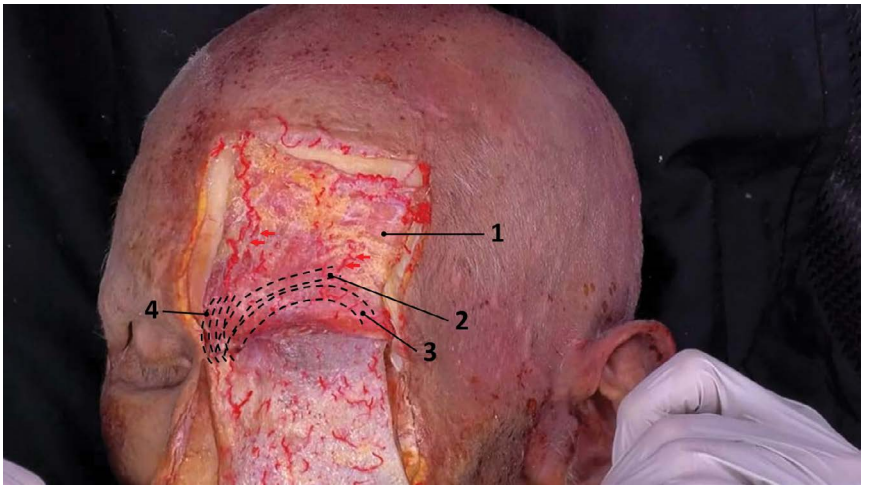

FIGURE 6.2 Cadaveric dissection of the left upper face. Note how the vasculature (red arrows) changes plane and travels above the frontalis muscle (1) at a mean of 14 mm cranial to the superior orbital rim. The frontalis muscle covers the forehead and invests into periorbital musculature at the eyebrow region; (2) depressor supercilii muscle; (3) orbicularis oculi muscle, and (4) procerus muscle.

frontalis muscle is the main elevator of the brow. Two muscle bellies are separated by a central muscle aponeurosis in many instances. Muscle fibers can extend past the hairline; in fact, the cranial aspects of the muscle act as a hairline depressor. The muscle thus exerts bidirectional movement axes, converging at the "C-line", approximately at 60% of the forehead length.

Two different types of facial lines exist: dynamic and static. Dynamic facial lines are formed by muscular contraction (i.e., frontalis muscle causing horizontal forehead lines or corrugator supercilii muscle and procerus muscle causing vertical and horizontal glabella lines). The musculature is connected to the overlying skin directly, as in the periorbital region, or indirectly, where the mode of action is transmitted through layers of fascia (forehead) and/or the superficial musculoaponeurotic system (SMAS) (midface) connecting the muscles with the skin. The muscles exert different movement axes, depending on the

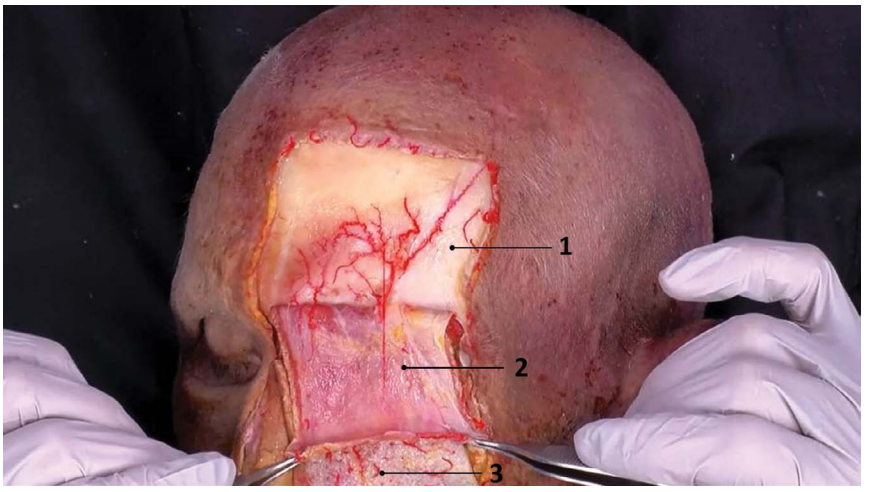

FIGURE 6.3 Cadaveric dissection of the left upper face. Note how the vasculature changes plane from deep (travelling superficial to the periosteum): (1) to superficial during the course of the vessels cranially; (2) subfrontalis fascia, retro-frontalis fat, frontalis muscle, supra-frontalis fascia, and subcutaneous fat; and (3) skin.

course of their fibers. The orientation of the rhytids formed on the skin surface is perpendicular to the muscle fascicle contraction, including patterns of horizontal and vertical contraction or radiating in a peripherally orientated manner. Static facial lines, however, are the result of different age-dependent processes. Over time and with increasing age, the muscles increase in length, increase in tone at rest, and have a reduced movement amplitude. In addition to facial muscle sarcopenia, the age-dependent loss of muscle volume, the tightening of the muscles, and the reduced amplitude of facial expressions can cause permanent wrinkles and accentuate skin creases due to muscular contractions and the shifting of position of overlying fat tissues.

6.1.2 Frequently Encountered Problems

The ideal forehead should be broad and square for males or oval with elegant curves for females. Forehead fullness is considered good for both genders. Senile changes of the forehead include narrowing and loss of dimensions and definition. The features of mild frontal bossing show femininity, while moderate prominence of the supraorbital ridge is considered manly. Over-bossing or lack of curving elevations can be suboptimal in elegancy (**Figure 6.4**). Gaps around the bossing or excessive depression of the frontal concavity impair the fullness and are generally disliked, especially by Asians. Over-prominence of the brow ridges appears coarse and the overtilted slope (**Figure 6.5a** and **b**) of the forehead presents a configuration comparable with primates. Both these traits vaguely reflect the size of the brain and are usually not considered smart in appearance. A skinny forehead, narrowing from aging, weakening, sagging and wrinkling of the soft tissues, and any unevenness in contour could all be the reason patients seek help for forehead correction (**Figures 6.6** and **6.7**).

6.1.3 Selection of Fillers

All kinds of filler theoretically can be applied to the forehead without difficulty but not every one of them would achieve satisfactory results. The senior author has published some personal techniques for forehead filler augmentation. Saline-facilitated injection is a valuable technique that helps to reduce the rate

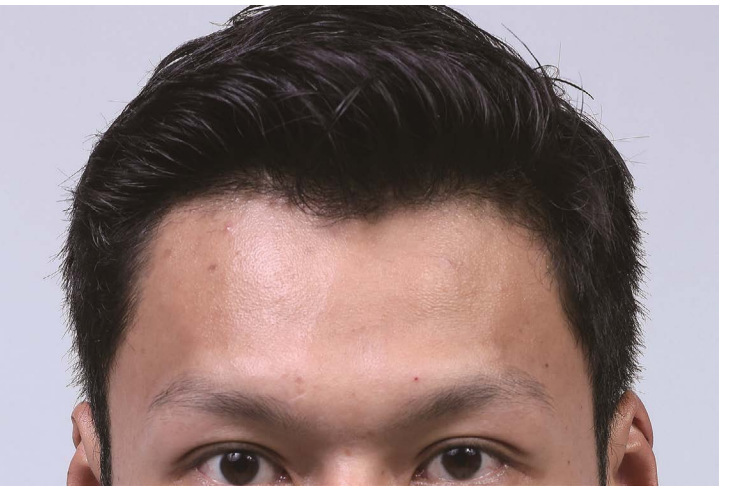

FIGURE 6.4 The common morphological problems of male forehead are narrow forehead dimension, uneven surface, over-prominent supraorbital ridges, and forehead concavity; all can be found in this young male. A narrow forehead dimension is often associated with narrow brow ridges and temporal hollowness.

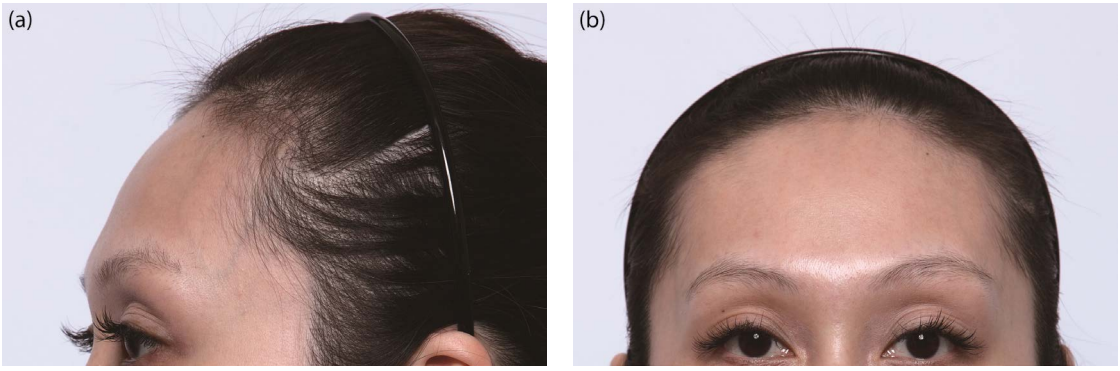

FIGURE 6.5 The ideal female forehead should be more vertical oriented with elegant curves and moderate brow prominence. (a) This young female has an overtilted skinny forehead. (b) The lack of soft tissue buffering also poses the forehead over-prominent in brow ridges and visible concaveness in the center and lateral borders.

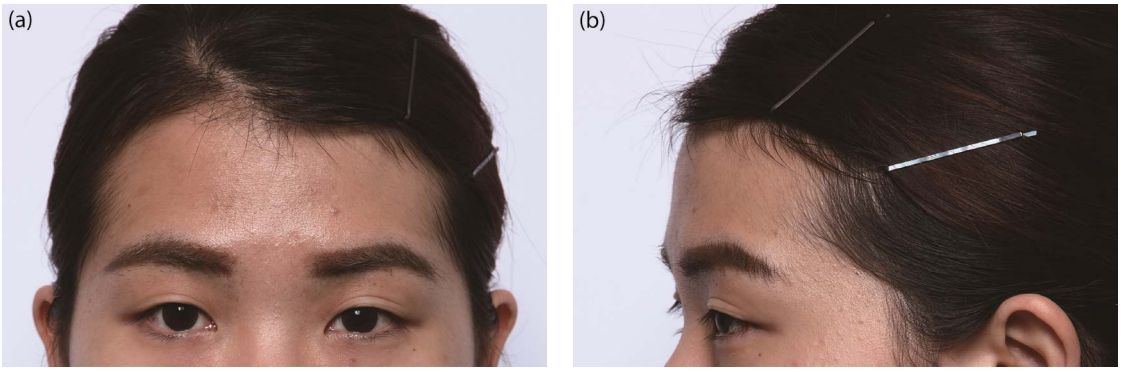

FIGURE 6.6 (a) This young female has a relatively small forehead. The dimension forehead is perceived not only according to the hairlines that set a visible border, but also the bony prominence and ridges. (b) The forehead of this girl also presents with a lack of convexity or fullness in the center, the junction with temples, and the glabella both in sagittal section and in transverse section.

FIGURE 6.7 The common problems of an Asian forehead include a flat front, gaps between prominences, hollow glabella, and bossing in suboptimal shapes. They all can be found in this young female patient.

FIGURE 6.8 (a) Forehead augmentation could balance a face by increasing upper facial dimension and anterior projection that are all required in this middle-aged woman. The wide cheekbone contrasts badly with the forehead. (b) What fillers can do is to augment the insufficiency and improve the proportions. Restylane Defyne is chosen in this difficult case to augment the forehead, nose, and chin. The ratio between upper and midface becomes more appropriate after the injection. The profile status is also improved with a more balanced anterior projection.

of intravascular injection and improve even distribution of fillers. Hyaluronic acid (HA) is widely used as an augmenting substance for the forehead but is often too soft to increase forehead width, to correct slopes, or provide projection (**Figure 6.8**). HA gel augmentation needs soft tissue for integration. Its gel property resumes when it is accumulated (**Figure 6.9**). Poly-L-lactic acid (PLLA) can be used in a pixelated manner but is very challenging in technique (**Figure 6.10**). Uneven distribution or forehead septa restriction could result in nodule formation (**Figure 6.11**). Polycaprolactone (PCL) injection can be similar to CaHA or HA, but dilution of PCL is less preferred and the consistency a little softer. Product distribution can be an issue for superficial injection of soft tissue fillers into the forehead, as the material cannot migrate past the fibrous canals created by the vertical course of the supraorbital and supratrochlear neurovasculature. When using a blunt cannula, appropriate subcutaneous subcision is required for even product distribution. In addition, it needs to be highlighted that superficial product administration in proximity to the supraorbital rim can cause product migration into the upper eyelid following the fibrous canal formed by the neurovasculature. Deep injections in the lower forehead and glabella region are considered high-risk procedures, due to the location of the vasculature.

FIGURE 6.9 HA filler forehead augmentation often has the problem of its soft character. This could be more prominent when fillers have been introduced in big amounts and accumulate in one tissue plane. However, for the problem of flatness, concavity, and slopes, there has to be enough volume to achieve visible correcting effects.

FIGURE 6.10 Pixelated PLLA injection has been described in the literature and in Chapter 4 for forehead recontouring. It is challenging in skill and carries a risk of nodule formation when the placement of PLLA liquid is near ligaments or not fine enough. (a) Forehead concavity, narrow dimension (along with the problem of suboptimal facial ratio), concave midface, and facial asymmetry are all well corrected by two stages of Sculptra injection. (b) The after photograph of the forehead presents male-patterned fullness and a balanced ratio between the upper and midface.

FIGURE 6.11 PLLA was administered in this female patient without sufficient training and resulted in uneven growth of tissue and several visible nodules.

6.1.4 Injecting Techniques

Because of the problem of forehead vasculature, injection – whether with cannula or needles – should preferably not proceed in the superficial fat compartment. Frontalis muscle is a very dynamic structure and usually does not cover completely the entire forehead. Superficial injection above the muscle and underlying the very thin layer of skin can be very unforgiving; any unevenness will be easily visible. Injection within in the frontalis muscle is possible but not preferred. Intramuscular filler injection is not the usual practice; muscles move and have a specific pattern of distribution. The deep fat compartment is a choice to accommodate fillers but for the forehead it is very limited in amount. Using cannula in the forehead area has to contend with many loose septal structures in order to reach different corners (Figure 4.4). Because of the wavy bony structure and the rigid character of a cannula, injecting directly with cannula dissection could not easily remain within a single layer (**Figure 6.12**). Hydrodissection with saline (using

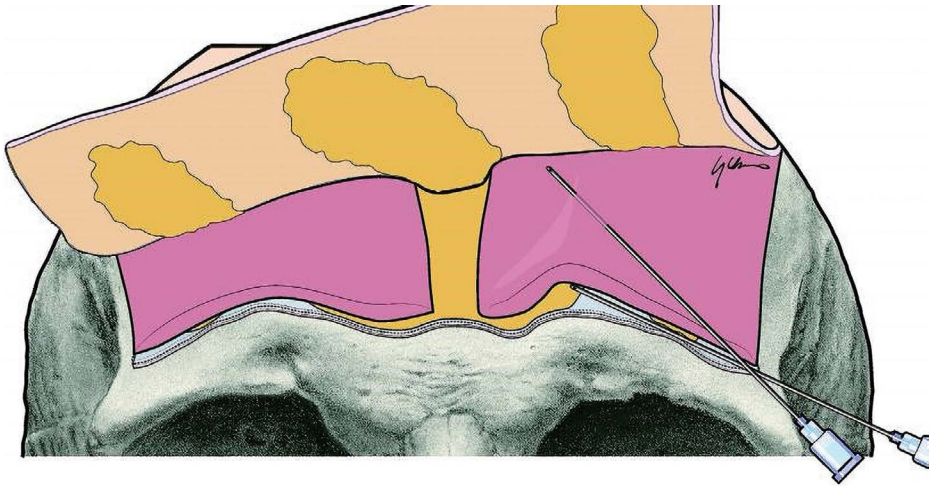

FIGURE 6.12 The cannula is often used for forehead injection to deliver fillers without the facilitation of saline dissection. Though it is considered uniform in a single layer, it often transverses multiple layers in practice.

the harmless liquid to prepare the subgaleal space) could evenly loosen these septa and facilitate an even distribution of fillers (see Section 4.3).

6.1.5 Cautions

Entry points of the forehead injection can be set medial to the temporal line. The frontal branches of superficial temporal vessels and zygomatic-orbital vessels form anastomosing networks above the brow. Piercing through the skin with needles in these areas should be targeted to the clear zones without underlying vessels showing through. Any advancement of the cannula should be slow and gentle whether the procedures are facilitated with saline dissection or not. When encountering resistance or patients feel pain, any movements of the cannula should be stopped first and redirected in a different angle. Tumescent or nerve block is controversial in dangerous areas because all the signs of danger could be numbed. For secondary intervention, as when patients need a refill, the space filled with any filling substance (all are believed to trigger some tissue reaction and consequent fibrosis, especially fillers with biostimulating properties) will have vessels inside that are more fixed and more adhesion, resulting in more resistance. Direct injection by cannula or needle dissection could become more dangerous here than in fresh cases. Patients with a history of forehead trauma, surgery, or fat transplantation are also high-risk groups; they should have conservative injection plans.

6.1.6 Clinical Effect and Limitations

Most of the above morphological deficits can be corrected or improved by injectable filler when an appropriate filler substance and filling technique is used. However, the longitudinal dimension is more related to the hairline and the bony framework. The horizontal dimension can be augmented with fillers added into bilateral borders, while the longitudinal dimension can be visually corrected by adjusting the profile pattern.

6.2 EYEBROW

The shape of the eyebrow is structured mainly by bony supraorbital ridge and the ROOF pad. The thickness of the skin and superficial fat has effects on the pattern of transition from the prominence to neighboring contours. Brow hairs are usually considered to correspond to the location of ROOF and the interdigitation of frontalis muscle and orbicularis oculi muscle but do not always continue to the most prominent part of the bony ridge.

6.2.1 Overview of the Anatomy (Eyebrow and Glabella Region)

As with the forehead region, the eyebrow and glabella region is composed of eight fascial layers. These include skin (layer 1), subcutaneous fat (layer 2), supra-frontalis fascia (layer 3), the frontalis muscle and orbicularis oculi muscle (layer 4), pre-septal and ROOF (layer 5), dense fascia in continuation of the subfrontalis fascia (layer 6), pre-periosteal fat (layer 7), and periosteum (layer 8) (**Figure 6.13**).

The eyebrow region is a region of extremely high mobility facilitated by the unique subcutaneous architecture where muscle fibers of the orbicularis oculi complex (including procerus, corrugator supercilii, frontalis, and orbicularis oculi muscles), connective tissues, and subdermal fat are strongly connected to the overlying skin. Below the musculature, the orbicularis retaining ligament (projecting the inferior

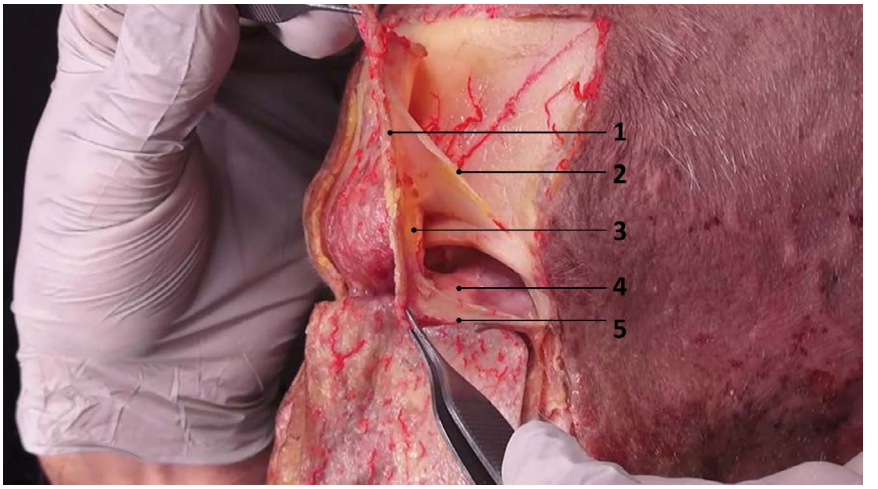

FIGURE 6.13 Cadaveric dissection demonstrating the layered arrangement of the forehead: (1) frontalis muscle, (2) subfrontalis fascia, (3) retro-orbicularis oculi fat, (4) orbital septum, and (5) orbicularis retaining ligament.

boundary of the hairy brow) separates the pre-septal fat (caudally) from the ROOF (cranially). Medially, the ROOF is bounded by the supraorbital neurovasculature and the dermal insertion of the corrugator supercilii muscle, while the temporal ligamentous adhesion is the lateral border. Cranially, the inferior frontal septum separates the ROOF from the retro-frontalis fat. The pre-periosteal fat lies beneath the ROOF, separated by a dense fascial sheet extending from the subfrontalis fascia. It has the same cranial (inferior temporal septum) and caudal (orbicularis retaining ligament) borders as the ROOF. The neurovasculature (supraorbital/supratrochlear) travels within the ROOF before coursing through the retro-frontalis fat. The supraperiosteal layer, deep to the subfrontalis fascia, can be considered relatively safe, as motor and sensory nerves (as well as the vasculature) course above it. Glabella lines are caused by muscular contraction of the procerus muscle (horizontal lines) and the corrugator supercilii muscle as well as medial fibers of the orbicularis oculi muscle (vertical lines). The bony origin of the corrugator supercilii muscle corresponds to the medial end of the non-contracted hairy eyebrow, while the procerus muscle originates in the middle of a line connecting the left and right medial canthal ligaments (**Figure 6.14**). It is a common

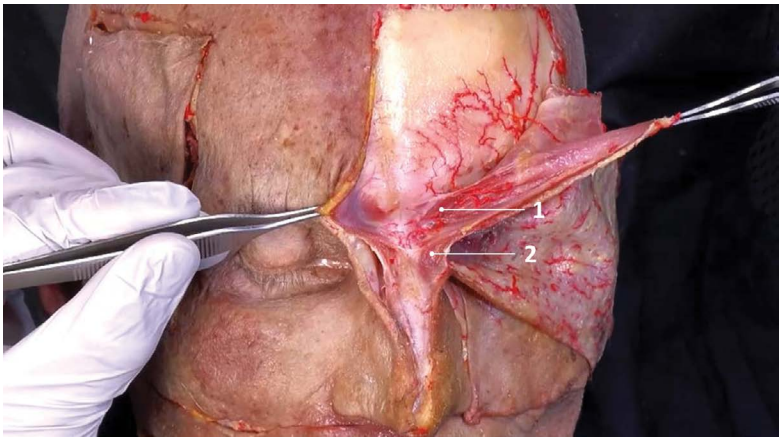

FIGURE 6.14 Cadaveric dissection of the left glabella region. The origin of the corrugator supercilii muscle (1) can be found at the supraciliar arch of the frontal bone. Note also the bony origin of the procerus muscle (2) at the nasal bone.

mistake to believe that the neurovasculature of the glabella region courses beneath the vertical glabella crease. Instead, ultrasound imaging reveals that the distance between the supratrochlear artery and the ipsilateral vertical glabellar line is approximately 10 mm, while it is approximately 20 mm for the supraorbital artery.

6.2.2 Frequently Encountered Problems

The brow contour should be considered a unit with the temples and forehead. Brow prominence should be smoother – corresponding to the brow arch – in females and thicker, wider, and more prominent in males. The dimension of the brow ridge should be compatible with the forehead and cheekbones. Aging change of the brow includes narrowing, loss of definition, brow ptosis, and hooding of the upper eyelids. Brow movements involve the glabella complex, frontalis, and orbicularis oculi. Muscle action and intervention could also interfere with the brow contour.

6.2.3 Selection of Fillers

Most fillers can be indicated for the brow, albeit with different characteristics. PLLA can be used in the supraperiosteal or the fat layer in moderate doses (**Figure 6.15**). Tissue growth from PLLA can be confined, depending on the injecting technique. Overdosing of PLLA usually results in thick bulging. HA used for eyebrow augmentation should have reasonable elasticity. The depot technique is preferred on the bone or in the subcutaneous layer and should comply with facial dynamicity (**Figure 6.16**). CaHA and PCL can be employed similarly as HA substances and can be proceeded in a more complex linear pattern. The creation of an ideal female pattern brow elevation is more artistic, which comprises smooth transitions to forehead, temples, and the orbits, necessitating good techniques and senses (**Figure 6.17**).

6.2.4 Injecting Techniques

Injection with the bolus technique employs needles. Linear injection in this area could use a needle or cannula. With concerns about vascular injection, needle injection in the linear pattern could be protected by the injector's other hand pinching the intended area or by being applied at a very superficial level.

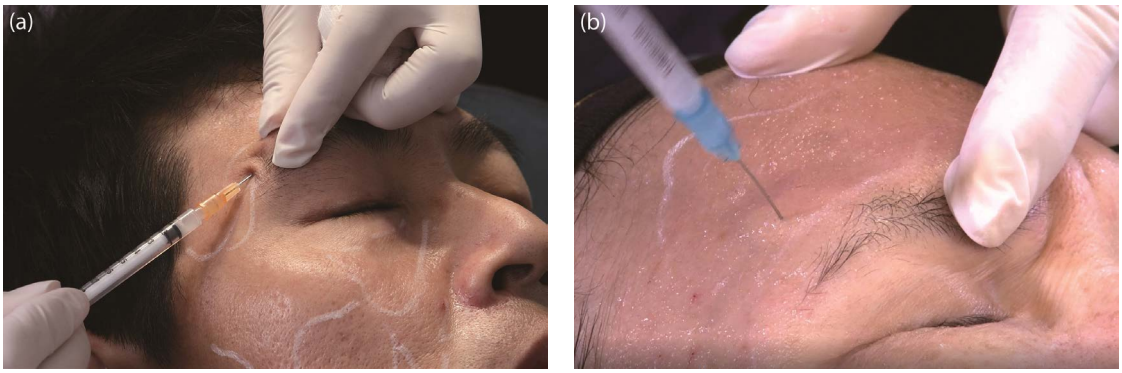

FIGURE 6.15 PLLA augmentation of the supraorbital ridge can be administrated either (a) by subcutaneous linear threading or (b) by supraperiosteal bolus depot.

FIGURE 6.16 Brow elevation could be achieved by bolus HA injection on the bone. HA fillers that are used to create the ridge contour should have reasonable lifting capacity. Vertical penetration with bevel down and enough aspiration is preferred to ensure injection safety.

6.2.5 Cautions

Complete upper facial enhancement should comprise the forehead, temple, and brow. Augmentation of the eyebrow without addressing the temple depression could adversely contrast with the temporal hollowness. Temporal volume also supports the brow soft tissue. Modulations of the brow by toxin should combine with fillers as well to achieve harmonious shapes and movements.

FIGURE 6.17 (a) The enhancement of the brow should be a holistic work comprising the forehead, glabella, and temples. The same patient as in Figure 6.7 has multiple morphological problems of the upper face. (b) Restylane Defyne is chosen for forehead augmentation along with the treatment for brows. The cannula technique in the subgaleal plane is used in combination with the focal needle approach. Restylane Volyme is used for the temples between the fasciae to have a better transition across the temporal-frontal borders. Elegant curves of brow prominence are created after the injection with good projection and convexity of the forehead. The temples and the glabella become fuller and compatible with the brow and forehead contours.

6.2.6 Clinical Effect and Limitations

In patients with brow ptosis, injection in the superficial layer or ROOF will increase the burden of the sagging but will have only a limited defining effect. Contour problems arising from tissue laxity that should be tackled with a tightening procedure should not be overtreated by fillers.

6.3 GLABELLA

The glabella is a critical area connecting the forehead to the brows, nose, and eyelids. It is a highly mobile structure with muscles of frontalis, corrugator, procerus, and orbicularis oculi interacting here. Additionally, many important vessels connecting the external carotid system and the internal one are distributed here, which makes the injection of filler more challenging and full of risks.

6.3.1 Overview of the Anatomy

Please refer to descriptions of the eyebrow/glabella region above.

6.3.2 Frequently Encountered Problems

The esthetic problems of the glabella, including dynamic wrinkles and static wrinkles, result from repeated muscle actions. The contour, fullness, transition, and curves of this territory are probably the most difficult aspects, as there should be a good balance to all the surrounding structures (**Figure 6.18**).

FIGURE 6.18 The glabella is a pivotal point connecting the forehead, brows, upper eyelids, and the nose. The pattern of fullness and projection is closely related to the height of the nose and the forehead profile. It is an important area and should not be left untouched in any comprehensive injectable facial treatment. However, the many important vessels behind the skin also make it potentially dangerous if treated by simple direct injection.

6.3.3 Selection of Fillers

Granular HA in smaller particles or softer gels can be applied for the grooves and wrinkles of glabella. These HA could also be employed (but by different techniques) to mildly modify the contour here. This area could benefit from the saline hydrodissection technique so that the extension of saline by manual pushing could prepare space better, enabling more versatile filler selection and easier application.

6.3.4 Injecting Techniques

HA fillers, when used for glabella wrinkles, should be placed as superficially as possible. The blanching technique requires the skill of placing HA in an intradermal or subdermal plane with visible blanching changes upon injecting and must be used with particular softer gel HA with high cohesivity. For severe deep grooves of glabella wrinkle, blanching techniques could appear too soft to lift the depression. Fillers with smaller particles but relatively high elasticity can be injected in a multiple puncture pattern in a very superficial plane to reduce the surface clefts. The injection plane in the dermal layer or dermal-subdermal junction is safer than the subcutaneous plane. However, the technique of hydrodissection with passive pushing of the dissecting fluid extending to the glabella protects the whole process, so the injector will not have to risk advancing instruments in this region (**Figure 6.19**).

6.3.5 Cautions

The common belief of using a cannula to protect from intravascular injection could not be applied to glabella injection. The cannula has been reported to have committed some severe vascular events. The soft tissue of the glabella is full of vessels anastomosing between arteries and veins, with diameters larger than capillaries and connecting between the internal and external carotid systems. When the injection is directed deeply upon the bone, the space in this area is relatively loose and fillers of HA could glide, deform, and dislocate under pressure.

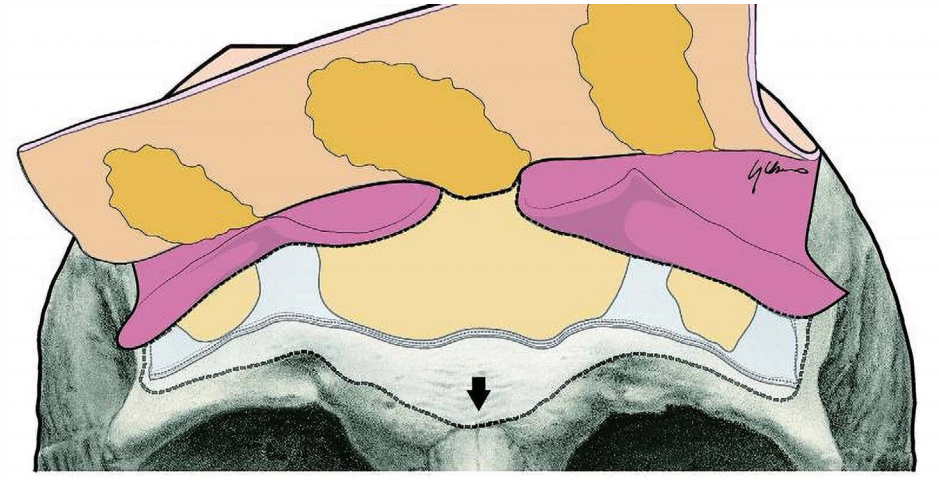

FIGURE 6.19 Hydrodissection can be adopted for the glabella region. With manual pushing downward, the hydrostatic pressure dissection could extend toward the nasal root. The subgaleal layer here is relatively loose compared with the forehead. Advances of the cannula should always be undertaken with great care, whether in the first stage of saline preparation or in the second stage of filler infusion.

6.3.6 Clinical Effect and Limitations

Some of the deep cutting glabella grooves could not be erased by filler injection. The ideal glabella curve should be balanced to the neighboring structures with reasonable transitions. That is not easy because of the mobility of glabella complex and because of upper facial identity and gender traits. With a severe depressive glabellar complex, the glabella plane could be depressed even below the average binocular plane. Filler augmentation is warranted in these cases to divide the forehead and the nose and shape the top of the brows. Secondary filling safety is another issue, especially when direct injection in the deep layer is performed. Patients with severe acne, prior surgery, or a history of trauma around here are a high-risk group for vascular damage.

6.4 TEMPLES

Temples are the bilateral upper corners of a face, being continuous with the forehead and the lateral cheek and separated from the orbit by the lateral orbital ring. They should be considered a unit with the brow and the forehead. Temples are the crucial parts deciding facial shape and the lateral transition between the mid- and upper face.

6.4.1 Overview of the Anatomy

The layered arrangement of the temple includes 13 distinct layers: skin (layer 1), subcutaneous fat (layer 2), superficial lamina of superficial temporal fascia (layer 3), deep lamina of superficial temporal fascia (layer 4) (**Figure 6.20**), deep temporal fat (layer 5), innominate fascia (layer 6), loose areolar tissue (layer 7), superficial lamina of the deep temporal fascia (layer 8) (**Figure 6.21**), superficial temporal fat pad (layer 9), deep lamina of the deep temporal fascia (layer 10), deep temporal fat pad (layer 11) (**Figure 6.22**), temporalis

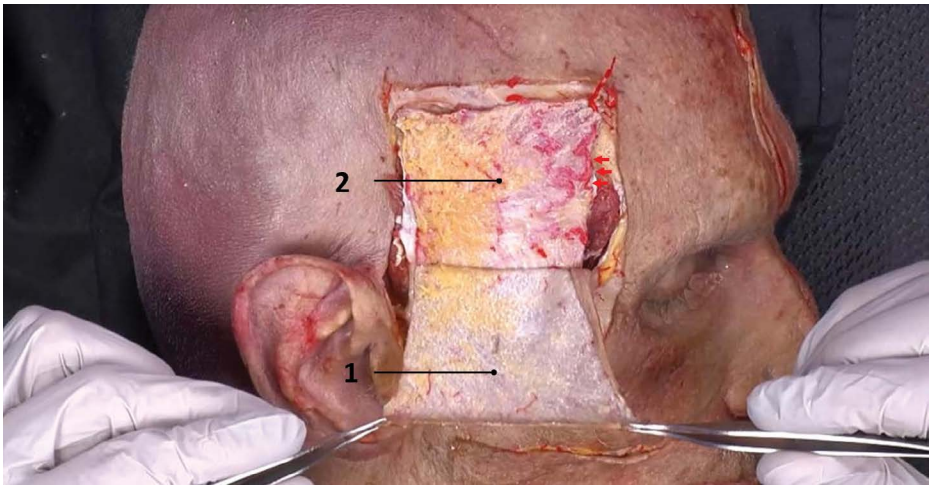

FIGURE 6.20 Cadaveric dissection of the right temporal region. The skin is elevated, (1) revealing the subcutaneous plane (layer 2). Layers 3 and 4 mark the strong superficial temporal fascia with its superficial and deep lamina containing the superficial temporal artery (red arrows). (2) Superficial fatty layer on top of superficial temporal fascia.

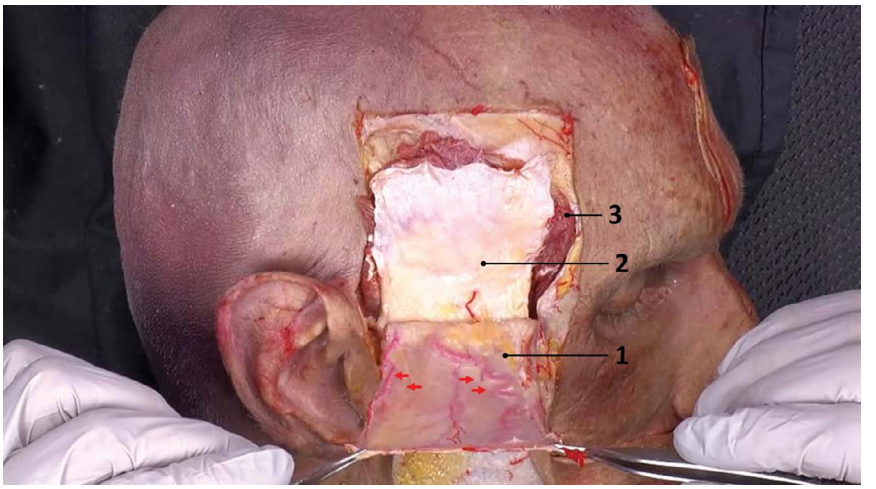

FIGURE 6.21 Cadaveric dissection of the right temporal region. The anterior and posterior branches of the superficial temporal artery course within the superficial temporal fascia (1). The deep temporal fascia (2) covers the temporalis muscle (3).

muscle (layer 12), and periosteum (layer 13) (**Figure 6.23**). Several techniques for soft tissue filler application in the temple exist, including subdermal, interfascial, and supraperiosteal (intramuscular) injections. Knowledge of the underlying anatomy allows for the most efficient, effective, and safe product placement, tailored to the individual patient's needs.

The following danger zones must be kept in mind. The superficial temporal artery courses within the superficial temporal fascia, enveloped between layers 3 and 4, after its emergence from the depth, 1-cm anterior and superior to the apex of the tragus. Motor branches of the facial nerve can be found within the deep temporal fat (layer 5). The sentinel vein travels below the innominate fascia in the loose areolar tissue of layer 7. The deep temporal artery courses beneath the muscle fibers of the temporalis muscle.

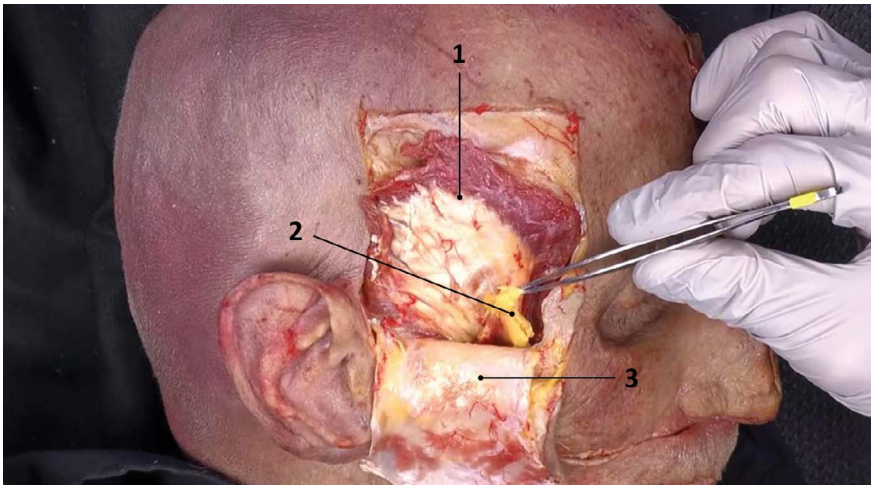

FIGURE 6.22 Cadaveric dissection of the right temporal region revealing the temporalis muscle (1) beneath the deep temporal fascia. The deep temporal fat pad (2) is the temporal extension of the buccal fat pad of Bichat located beneath the deep lamina of the deep temporal fascia. (3) Deep temporal fascia (superficial lamina, superficial temporal fat pad, deep lamina).

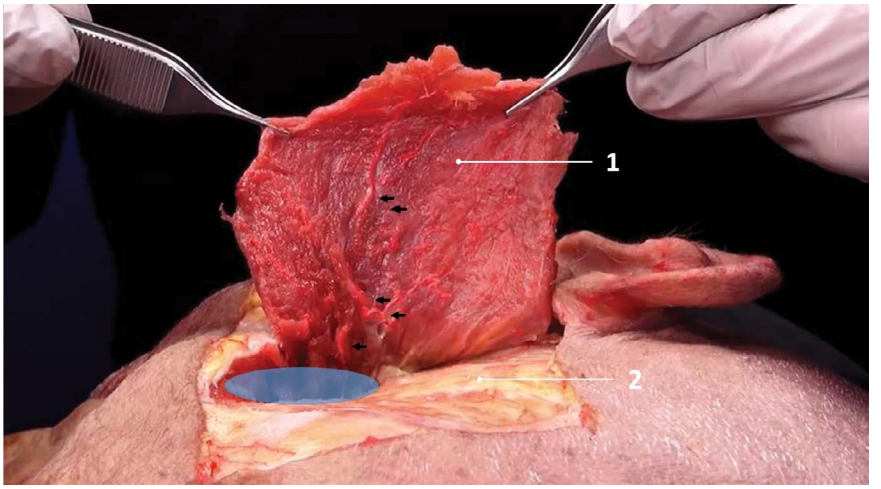

FIGURE 6.23 Cadaveric dissection of the right temporal region revealing the vasculature (black arrows) beneath the temporalis muscle (1). The anterior and posterior deep temporal arteries travel superficial to the periosteum (2). Note the concavity of the temporal fossa (blue shaded area).

6.4.2 Frequently Encountered Problems

Temples show little variations of the curve but different levels of fullness. The temporal fossa is filled with temporalis muscle, different layers of fat, fascia layers, and skin. All these structures contribute to the collective volume of this area. The more artistic issue for temple enhancement is the continuity and transition to the forehead and cheekbones, especially on the temporal lines. Gaps occur here when soft tissue diminishes and would be considered an aging shape. Patients often ask for correction of concave temples that give an impression of the body wasting or suffering (**Figure 6.24**).

6.4.3 Selection of Fillers

For augmentation in the temporal area, filler substance can be filled in the superficial subcutaneous layer, the layer between superficial fascia and deep fascia, and the plane below temporalis muscle. Fillers to be

FIGURE 6.24 (a) The frontal appearance of a face with temporal volume depletion is not compatible with a healthy image and is more like the configuration of a peanut. (b) The border of the temporal fossa is surrounded by dense septa of the orbit, the temporal line, and the zygoma.

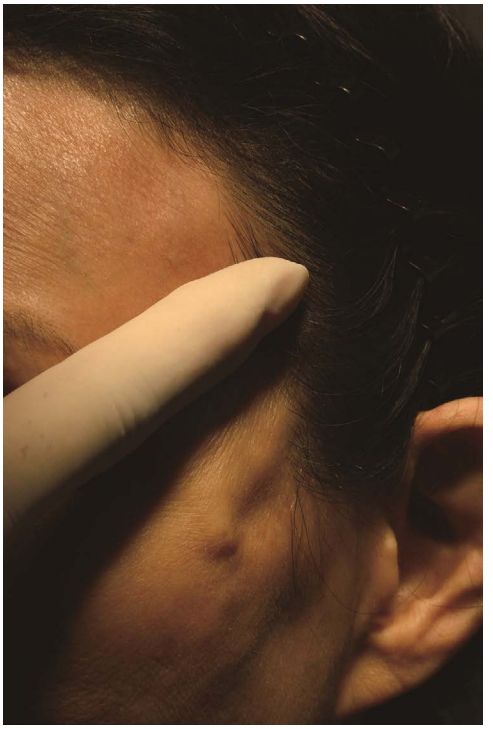

FIGURE 6.25 The HA filler between superficial and deep temporal fascia is still mobile weeks after injection. The confluent plane enables the gel substance to migrate within the space and behave like a gel.

filled in the superficial layer should be placed evenly since it is easily detectable and more unforgiving there. HA fillers with a softer texture and more spreadability are the filler of choice. The filler for the interfascial plane should be limited in amount and preferably less mobile, to prevent fluidity between the continuous interfascial plane as a free space (**Figure 6.25**). Fillers with biostimulating potential are not suggested to be used in this layer because of the close relationship of vascular structures and the fascial plane. Fibrosis of the space would make a subsequent approach in this layer full of risk. Fillers to be used in the supraperiosteal plane should be more fixing in character. Gel particles could move down along the bone when filled in a large amount. PLLA is frequently used in this layer for the gradual but long-lasting effect. Bony depots can be achieved easily with needles; needle injection of liquid PLLA through multiple layers here is more appropriate than for other fillers with fewer concerns about vascular events from backward flush (**Figure 6.26**).

6.4.4 Injecting Techniques

The cannula should be employed for work in the superficial fat plane and the interfascial plane (**Figure 6.27**). As resistance exists in both layers, limiting the spreading of fillers, more passages are needed for more thorough coverage and more even distribution of the filler. Supraperiosteal delivery of fillers should proceed with needles with enough aspiration checkup. Importantly, when injecting deeply, the potential to pierce the anterior branch of the deep temporal artery must be considered. Superficial injection is considered generally safe, as no important neurovasculature courses this plane in the temple. However, too aggressive fanning should be avoided, as an extensive destruction of the retinacula cutis and the subdermal plexus can cause regional necrosis. The interfascial technique is considered relatively challenging. The cannula is inserted with periosteal contact just medial and inferior to the hairline. It is then advanced toward the temple and loses periosteal contact after passing the temporal crest where the frontal

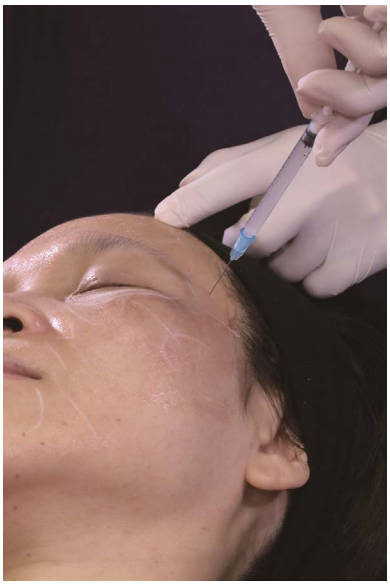

FIGURE 6.26 Though the submuscular layer is considered continuous with the midface, the liquid form of PLLA stays in liquid form only temporarily. When water inside the mixture is reabsorbed, the PLLA crystals stay in the supraperiosteal layer, stimulating tissue, with little tendency to move across.

periosteum transitions to the deep temporal fascia. Here, the cannula now glides within layer 7, the loose areolar tissue of the temple. The motor branches of the facial nerve are protected by the innominate fascia. However, the sentinel vein lies within the plane of product administration and can be injured.

6.4.5 Cautions

When fillers are used in the interfascial space, the paucity of intervening tissue would make the filler substance collect together and exhibit fluidity. Deep temporal vessels penetrate below the temporalis muscle. Bleeding from vessel puncture could present as an inflation of the muscle or needle blood reflux. Supraperiosteal space is relatively loose and overfilled deep gel-like fillers could descend. Molding is important to facilitate the spreading of fillers in the temples.

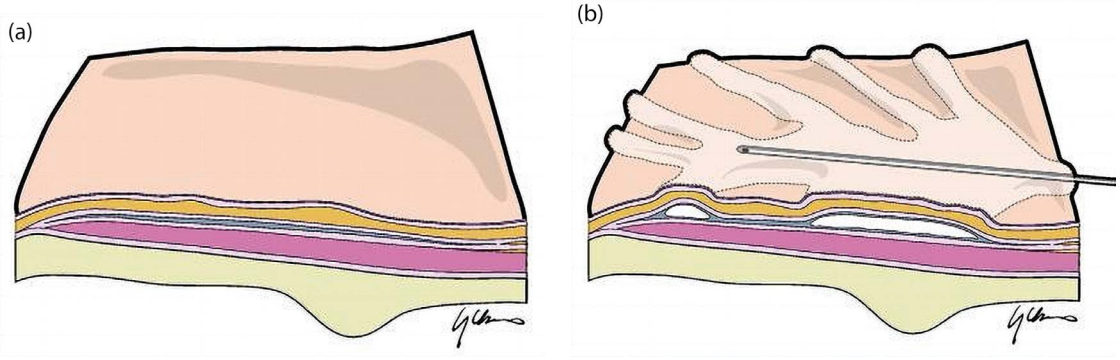

FIGURE 6.27 (a) Interfascial cannula deployment of filler is actually a process of tissue dissection that creates multiple interconnecting channels. (b) Incomplete coverage of the cannula passages could result in instable and uneven volume augmentation.

6.4.6 Clinical Effect and Limitations

The filling efficacy would be lower when fillers are filled below thicker soft tissue, especially below the muscle, such as temporalis. Fillers filled superficially have to be placed evenly enough because any faults in such a superficial location would be easily detectable.

6.5 UPPER EYELID COMPARTMENT

The upper eyelid is not a usual treatment area for injectable fillers. For the injecting technique, it is challenging to control injection depth and adjust dosage.

6.5.1 Frequently Encountered Problems

Depending on ethnic features, sunken eyes are common in some people as a hereditary trait (**Figure 6.28**). With the laxity of the upper eyelid and sagging of the soft tissue in the upper eyelid compartment, the regional topography changes with the lower looking fuller and the upper deficient. However, when these patients are lying down, the effect of gravity is neutralized and the contrast diminishes. That explains why the true gap in volume to the optimum might be greater than we think (**Figure 6.29**).

6.5.2 Selection of Fillers

HA fillers are most appropriate for this area. Fillers used here should be smaller in particle size and well saturated in water equilibrium.

6.5.3 Injecting Techniques

Using a cannula to dispense a trace amount of HA filler is the usual manner of treatment. Extra-septal injection of fillers with good merging with peripheral curves is crucial. Fillers are ideally added locally;

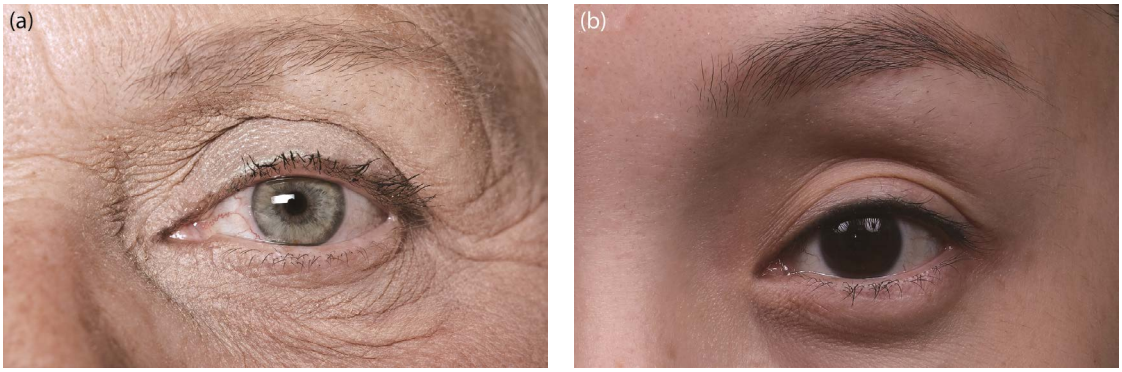

FIGURE 6.28 Sunken eyes are usually hereditary. (a) They are prevalent in some racial groups and become more prominent with aging. (b) They are less common in Asian populations but can appear early, not associated with aging in subjects presenting with this trait.

FIGURE 6.29 (a and b) This young Asian female with sunken eyes was corrected with Restylane Skinbooster via cannula injection. The treatment goal for the sunken appearance is to diminish the depth of sinking rather than transform it into a different appearance. The upper lid injection is most challenging with border feathering and merging with surrounding tissues. All the faults of a bad injection will be easily visible when patients look down. (c and d) The after photograph of this patient is smooth and reasonably full when compared with the condition before.

whole eyelid layering of filler will give puffiness and can rarely look natural and even. The injection level should be above the orbital septum and could be considered along the orbital rim (**Figure 6.30**). The amount to inject should be as little as possible.

6.5.4 Cautions

In patients who have deep-set eyes, injection of the filler should not exceed their original state. A patient's photographs are a valuable reference for the endpoint. Undertreatment is always the best policy around the eyes. The step of molding along the orbital rim after injection is important to make sure the merging is sufficient (**Figure 6.31**).

6.5.5 Clinical Effect and Limitations

The contrast between the brow and the upper lid furrow could be reduced (see **Figure 6.29**). However, the upper lid problem could result from the laxity of tissue, ptosis of the brow and redundancy of the eyelid skin/muscle complex, or weakness of the musculoaponeurotic system. Filler injection should not be overemployed for its effects on the eyelids.

FIGURE 6.30 The deficient area should be clearly marked out before the procedure. The cannula is inserted by the lateral approach and kept adherent to the bone.

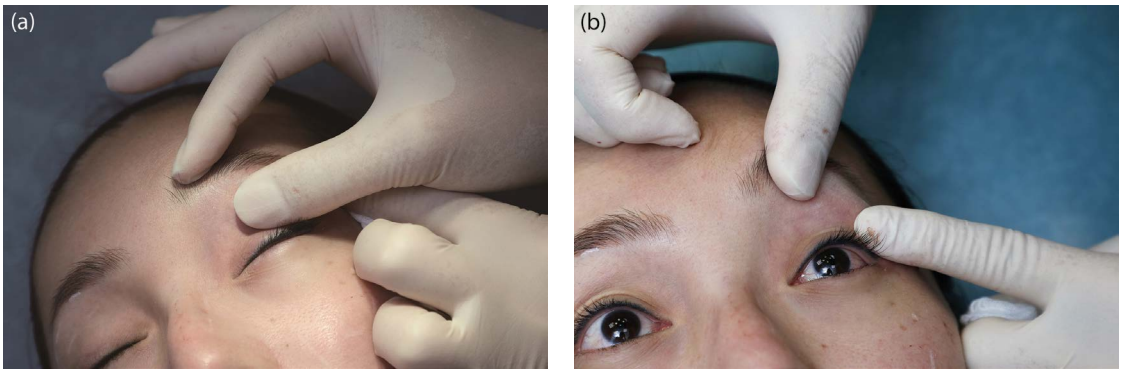

FIGURE 6.31 (a and b) Molding of the inserted HA gel can be applied against the bony rim to make sure all the thickness, distribution, and feathering is as desired.

6.6 LATERAL CANTHAL TRIANGLE

The lateral canthal area is an over-neglected area in esthetic injection. As aging proceeds, with tissue laxity and soft tissue volume changes, this area usually appears empty, along with other aging-related scenarios.

6.6.1 Frequently Encountered Problems

Underlying the lateral canthal skin is the lateral canthal ligament, which is the attaching point where the orbicularis oculi muscle connects with the orbital rim, functioning as a fixation sling. The soft tissue laxity rests upon the relatively fixed point, while the lower soft tissue descends. A gap then appears.

Sometimes the tear trough and palpebral-malar grooves are treated with fillers, which leave this area strangely empty.

6.6.2 Selection of Fillers

HA fillers that are appropriate for superficial injection are indicated.

6.6.3 Injecting Techniques

This area is tiny. Though it is within the contracting territory of orbicularis oculi, it appears relatively stable as its fixing point. Fillers are preferably to be injected superficially and in a minimal amount. Needles are more adroit here. Point depot and a small fan could both suffice for this task, while molding after injection is mandatory (**Figure 6.32**).

6.6.4 Cautions

For patients with hyperactive crow's feet, toxin can be considered to modulate the activity of the lateral orbicularis oculi muscle.

6.6.5 Clinical Effect and Limitations

Without concomitant filling of the lateral canthal space, periorbital injection can look somewhat weird and unnatural. Feathering is another option if the injector can titrate the dose when approaching more laterally to match the entire orbital area.

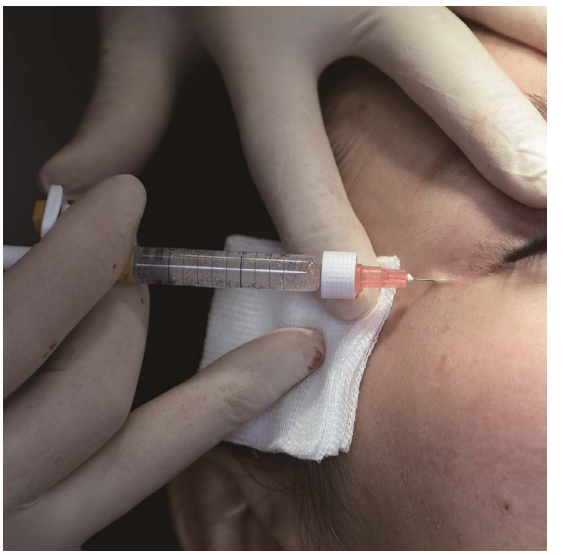

FIGURE 6.32 Restylane Skinbooster is used for the lateral canthal fossa and administrated with a sharp needle. The injection layer is very superficial; injectors should easily manage to avoid the vessels by visual examination.

6.7 PRETARSAL FOLD

A pretarsal roll can be visible in patients of different ethnicities. It is formed by the lower lid muscular insertion to the skin and musculoaponeurotic system. Because it is magnified when smiling, eyes with pretarsal rolls look smiley, cute, and more expressive. It is desired in younger patients and considered attractive.

6.7.1 Frequently Encountered Problems

Patients who seek injection over the pretarsal region can be divided into the group devoid of a pretarsal roll even when they smile, the group with minimal rolls, the group with suboptimal rolls (asymmetry or broken rolls), and the groups with wide or over-prominent rolls. The problem in patients with over-prominent rolls could be muscle-related or fat-related; they should be treated first with lower lid procedures, including fat removal, muscle modulation with a toxin, tightening techniques, and trimming or fixation surgeries.

6.7.2 Selection of Fillers

HA fillers appropriate to be used superficially are indicated. As the filler is expected to form a roll, fillers with softer character are not the choice.

6.7.3 Injecting Techniques

A cannula extending as a curve approximately to the eyelash in the same superficial level is the best tool to lay HA evenly along the pass (**Figure 6.33**).

FIGURE 6.33 Molding after HA is laid down with a Q-tip is a useful tip to help further limit the extent of filler distribution.

6.7.4 Cautions

For a patient with thin skin, light scattering through the superficial HA gel could give a blue hue or appear with a gel-pattern shine. Hydrophilic substances draw water. For injection conducted with fillers with a greater tendency to swell tendency, an overdose or asymmetric or uneven placement are all disasters. When fillers are injected too deeply or at a distance from the eyelashes, it will not be a roll anymore but more like puffiness from crying.

6.7.5 Clinical Effect and Limitations

The genuine pretarsal roll is a prominence dynamically appearing when muscles around the eyes contract; the pretarsal roll created by injection is an artificial structure that presents anyway without muscle contraction (**Figure 6.34**).

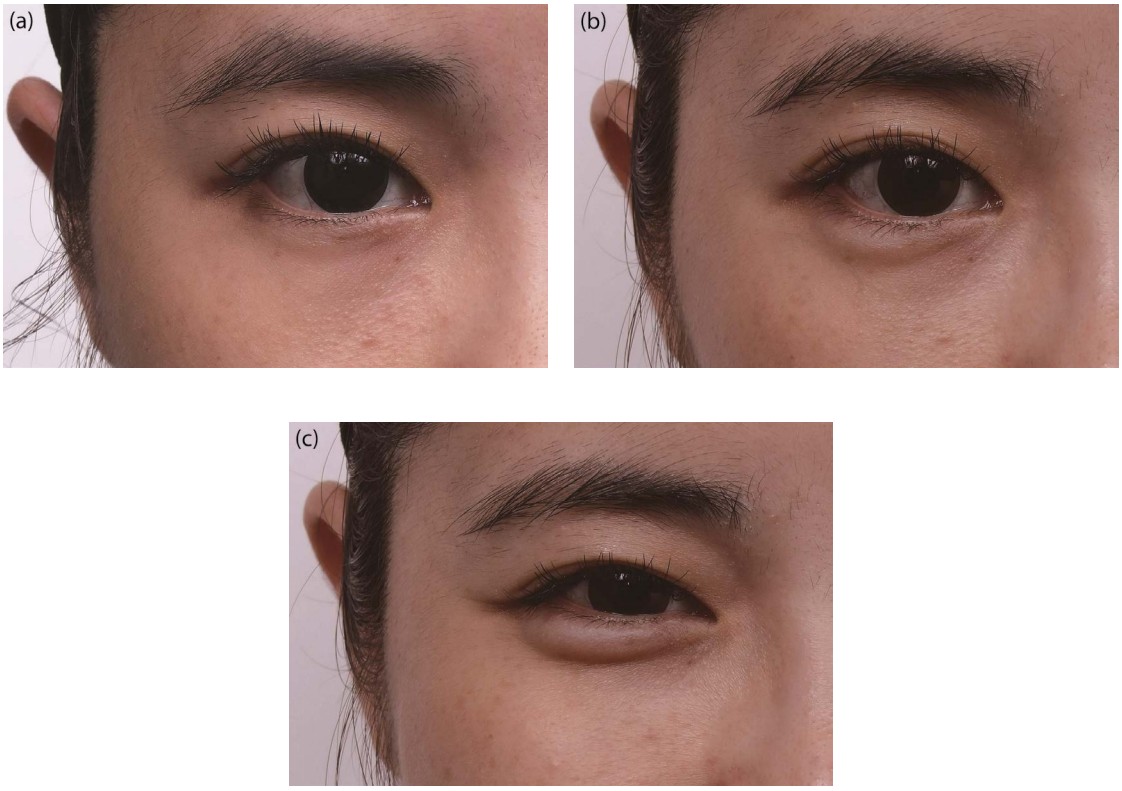

FIGURE 6.34 (a) Restylane Skinbooster is used in this young female for creating the pretarsal roll. (b) The distribution of HA particles is much targeted and exactly visible through the thin skin. (c) The graduated thickness of the roll has to be compatible with the curve of the lower lid, with tapering in both ends. Makeup could cover the scattering hue. The natural bulging of the roll is clearly visible and almost the same as the genuine one when the smiling orbicularis oculi muscle tenses up the skin.

6.8 INFRAORBITAL HOLLOW, TEAR TROUGH AND PALPEBRAL-MALAR GROOVE

The infraorbital area is probably the target for which patients ask for treatments most often and also the most common area where injections have problems. The overlying soft tissue – including skin and the aponeurotic orbicularis oculi muscle – is very thin and delicate (**Figure 6.35**), highly mobile, and vulnerable and is the structure showing the first sign of aging.

6.8.1 Overview of the Anatomy

The infraorbital region is extremely delicate. It is subdivided into a medial and lateral part in relation to the medial margin of the pupil, which differ in their layered arrangement. Medially, the infraorbital region is made up of only three fascial layers, including skin (layer 1), orbicularis oculi muscle (layer 2), and periosteum (layer 3). The angular vein is located in the depth of the nasojugal groove approximately 4 mm inferior to the inferior orbital rim and travels within the orbicularis oculi muscle from inferolateral to superomedial. The angular artery travels in a vertical orientation medial and parallel to the angular vein. Laterally, the infraorbital region is composed of seven fascial layers, including skin (layer 1), subcutaneous fat (layer 2), orbicularis oculi muscle (layer 3) (**Figure 6.36**), suborbicularis oculi fat (SOOF, layer 4), deep fascia (layer 5), preperiosteal fat within the prezygomatic space (layer 6), and periosteum (layer 7). The zygomatico-cutaneous ligament borders the SOOF inferiorly, while superiorly the orbicularis retaining ligament can be found. The zygomatico-cutaneous and orbicularis retaining ligaments fuse at the medial end of the SOOF, forming the tear trough ligament (**Figure 6.37**).

6.8.2 Frequently Encountered Problems

Esthetic issues of this area are related to tissue laxity, volume discrepancy, ligament marks, and descending malposition. Injectors have to differentiate where and why the problems originate. The bulging of

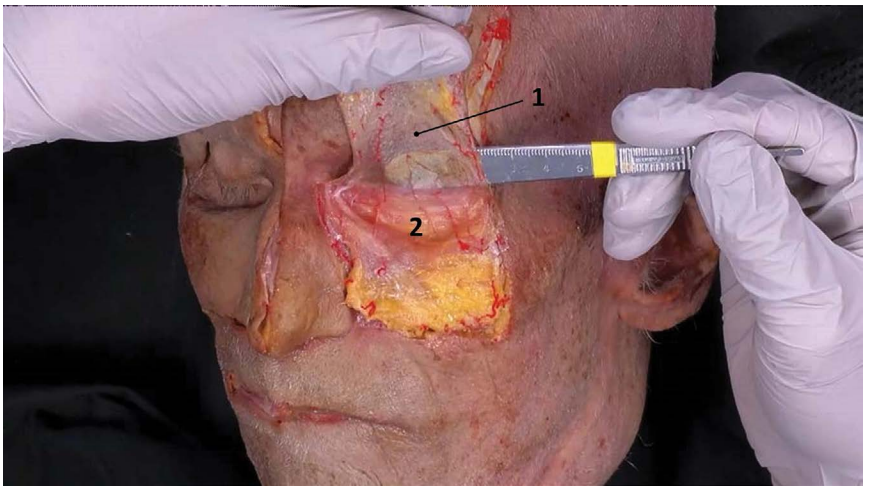

FIGURE 6.35 Cadaveric dissection of the left infraorbital area. This region is very delicate and the skin (1) covering the orbicularis oculi muscle (2) is extremely thin; note the visibility of the forceps.

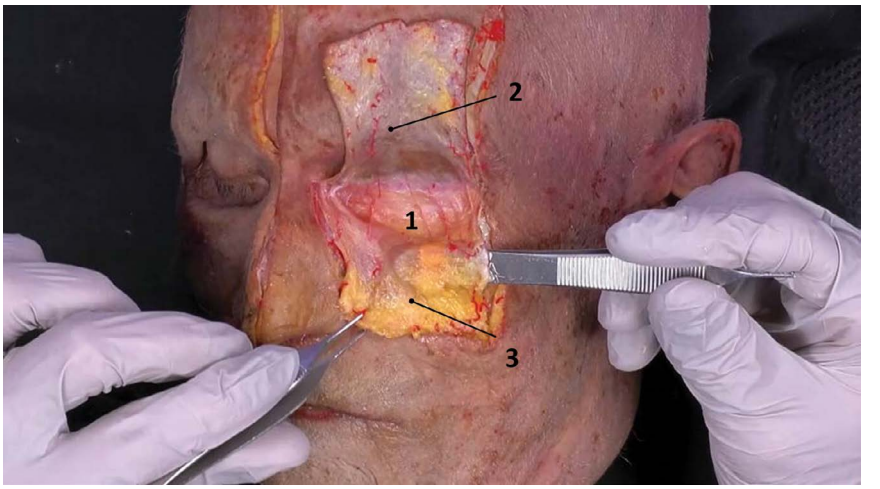

FIGURE 6.36 Cadaveric dissection of the left infraorbital area. The forceps is placed below the orbicularis oculi muscle (1) bordered by the orbicularis retaining ligament and the zygomatico-cutaneous ligament, marking the borders of the SOOF; (2) skin; and (3) superficial malar fat pad.

intra-septal fat is often related to orbital septum weakening and tissue laxity. Tissue laxity or redundancy should be treated with surgical trimming. Energy-based devices, light-based treatment, and mid-to-deep chemical peeling could reverse the problem of superficial laxity but are less effective to reach deep problems. Ligament marks usually get worse because of aging/laxity, wasting of superficial tissue buffering, and iatrogenic reasons such as overfilling. Static infraorbital fine wrinkles, palpebral-malar grooves, the tear trough, nasojugal grooves, and the depression related to boundaries of fat compartments, ligaments, or septa are often treated with filler augmentation or camouflage. Chronic dynamic lines could turn into fixed indentations. Muscle contraction could interfere with filler distribution. All these points favor combining filler treatments with toxin modulation.

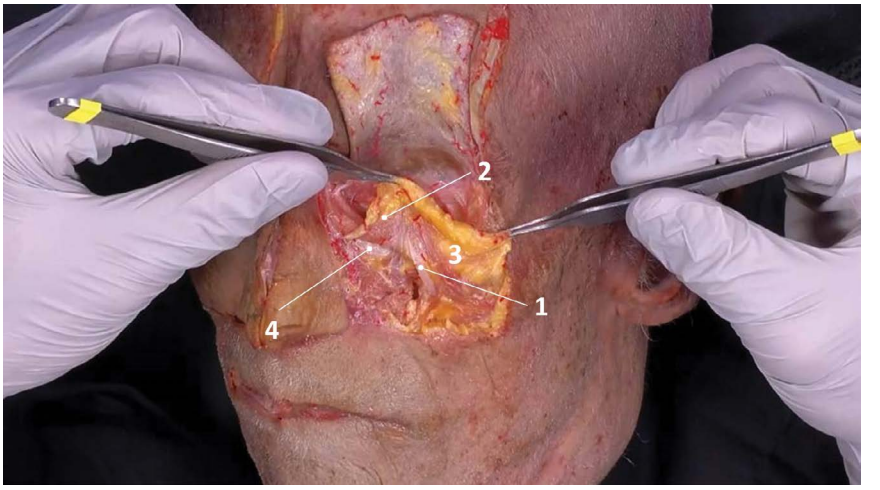

FIGURE 6.37 Cadaveric dissection of the left infraorbital area. The facial vein (1) is located in the depth of the nasojugal groove and travels within the orbicularis oculi muscle (2) from inferolateral to superomedial. The zygomatico-cutaneous and orbicularis retaining ligament fuse at the medial end of the SOOF (3), forming the tear trough ligament (4).

6.8.3 Selection of Fillers

HA fillers are frequently used in the infraorbital area. HA fillers of different lifting capacity could be allocated to layers from deep to the surface, but HA products with a swelling tendency should be avoided around the eye. PLLA can be reserved for very advanced users to augment volume and treat the problem of tissue laxity here. PCL is noted to result in prominent tissue reaction around the eyes; CaHA sometimes creates prolonged erythema under the eyes.

6.8.4 Injecting Techniques

Fine lines of the periorbital area can be addressed with cohesive soft HA by the bleaching technique. The ligament marks related to tissue laxity can be improved by deep buttressing of the ligaments with point depot of fillers by sharp needles. The deep fat compartment of the SOOF is usually addressed by a cannula or carefully with needles (**Figure 6.38**). Midface augmentation could tent up the periorbital tissue and improve gaps and depressions of this area and should be combined with periorbital manipulation. A thin layer of filler can be administrated superficially with a cannula to mimic the buffering effect of the young superficial fat tissue (**Figure 6.39**).

6.8.5 Cautions

Filler injection could not meet all infraorbital esthetic goals but would complement the other aspects of tissue tightening and surgery. The superficial fat compartment of this area is very close to the surface and is interfaced with very thin skin. HA filler collection in this layer is easily visible with a hue of colloid scattering (**Figure 6.40**). Fillers in this highly mobile region should be used with additional care to avoid dynamic awkwardness when there is contraction of the muscles of levator labii superioris, levator labii superioris alaeque nasi (LLSAN), and zygomaticus major and minor. The strategies to avoid this suboptimal result consist of injecting fillers deeply below the muscles, conservative dosing, or very superficial placement with multiple tiny depots (**Figure 6.41**).

FIGURE 6.38 The lateral approach is preferred for administrating fillers in the infraorbital deep fat layer with a cannula. Belotero Intense is used in this case to provide deep support and better tissue integration.

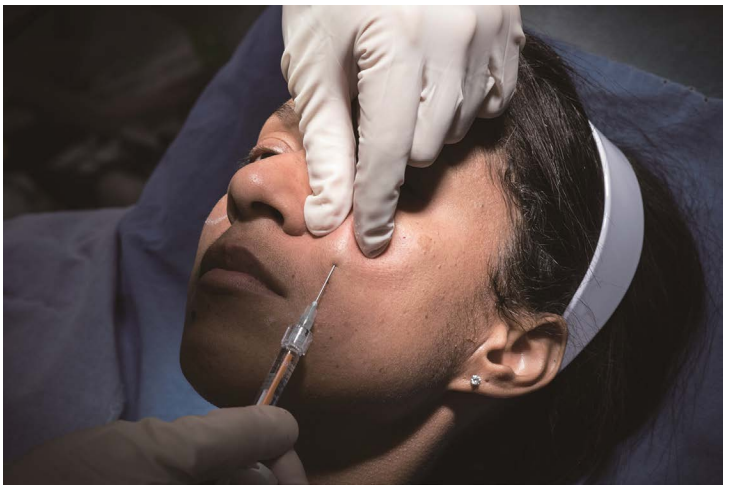

FIGURE 6.39 Superficial plane layering of the HA filler is preferably administrated via an inferior approach as it crosses the ligaments and provides some tenting effects. Belotero Balance is chosen for this work for its softer character and better cohesivity. The use of a guiding finger here ensures the cannula is in an appropriate layer.

6.8.6 Clinical Effect and Limitations

HA fillers generally are agreed to be more controllable for this region but the integration with tissue is only limited. That is why infraorbital injection results could change with time under muscle movements. The supraperiosteal space is in the deep plane less disturbed by most of the mimetic muscles; however, at the level of the infraorbital area spaces such as the prezygomatic and premaxillary are all above the muscles of the levator labii groups. Filler used in these spaces is still in a mobile state and being squeezed by muscle excursion. The relatively loose structure in these spaces further increases the instability of HA fillers used here. The infraorbital and medial cheek problems should be considered together as they

FIGURE 6.40 It is suboptimal to overfill patients and obliterate normal landmarks without respect to the whole facial balance and natural facial curves. The transparent HA substance gathered below thin skin scatters light with a blue-to-green hue.

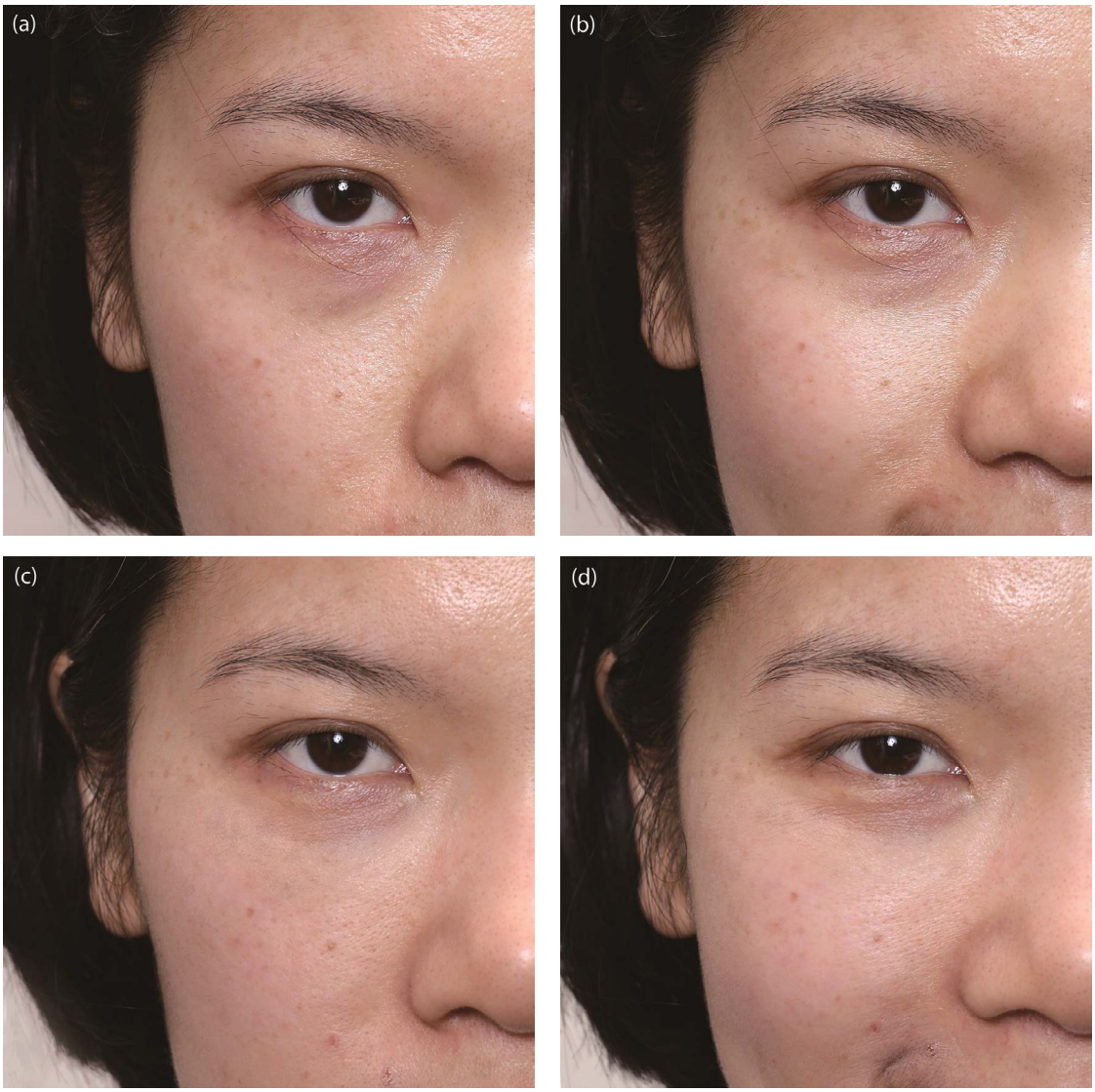

FIGURE 6.41 Multiple superficial microdroplet HA deposition can also improve the facial contour. (a) This young female has a flat front and deficient medial cheek fullness. That appears in the infraorbital region as a groove and volume discrepancy. The lower lid skin is extremely thin, so that the orbicularis oculi muscle is visible through. (b) The problem also presents when she smiles and can easily give a tired impression. (c) Restylane Skinbooster is used here with sharp needles via the multiple droplet superficial technique. Mild bruising is visible one week after the injection. (d) The medial cheek contour is naturally improved in both static and dynamic states.

can impact on each other. PLLA is widely used for cheek problems and can be skillfully used in this region to improve tissue quality and volume discrepancy (**Figure 6.42**). Bear in mind that the thin fascial arrangement of the tear trough region is prone to product visibility, surface irregularities, and discoloration. In addition, lymphatic outflow mediated by the orbicularis oculi muscle (OOM) can be hampered, causing significant and long-lasting edema in this region. A soft product is recommended for injection.

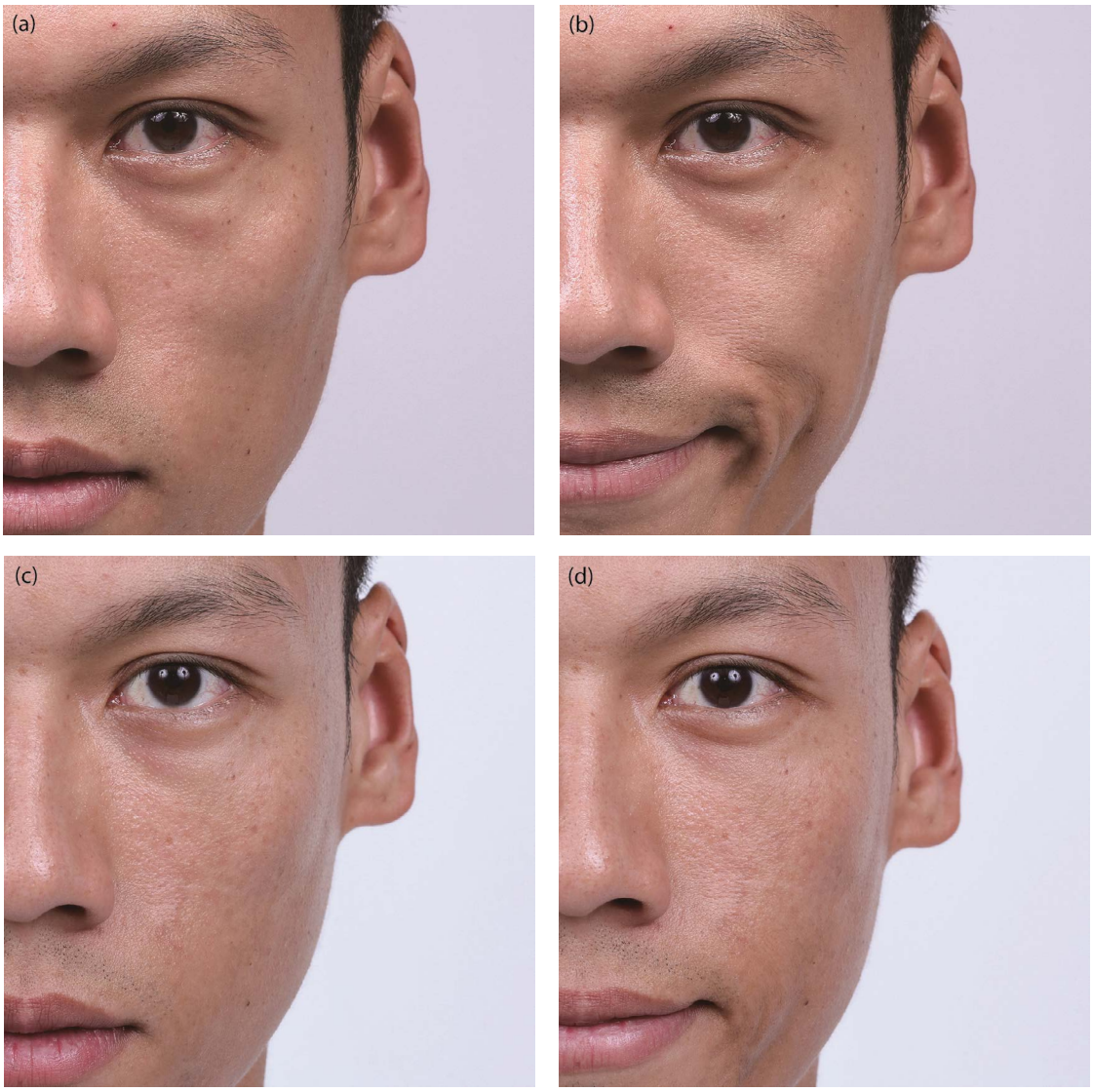

FIGURE 6.42 (a) This thin young male is augmented with Sculptra, by needles for two sections. (b) The deficiency of subcutaneous fat tissue is in both superficial and deep fat layers. (c) PLLA is administrated to the deeper layer of the cheek in different regions, including the infraorbital region. (d) Male treatments should adopt injection techniques different from those for females to avoid a feminized fullness. Though being classified as deep fat compartment, the infraorbital region injection is still superficial in depth and needs very advanced skills. The after photographs appear natural in volume restoration, skin quality, and the transition between the treated areas and the original curves. Good dynamicity of the new tissue is clearly visible.

6.9 MALAR GROOVE

The malar groove rests upon the zygomatic bone due to the true zygomatic-cutaneous ligament which tethers the skin down.

6.9.1 Frequently Encountered Problems

The malar groove is visible only in some subjects as a familial trait. It can be visible in the resting state and more prominent in smiles when the muscles of zygomaticus major and minor contract. Volumizing fillers should be reserved for problems of volume instead of being excessively extrapolated for functions such as lifting and so on. Though filler injection could improve skin quality via biostimulation, the use of biostimulating agents should be more restrained in the infraorbital area. It usually becomes prominent with age because of the gradual loss of superficial fat that attenuates the gap and because of the descent and laxity of soft tissue that deteriorates the discrepancy between the ligament-attached points and the baggy protruding parts. Malar bag or edema that occurs above the ligament usually overshadows the groove and makes it more prominent.

6.9.2 Selection of Fillers

HA fillers of high elasticity or CaHA are indicated for deep-seated injection. HA fillers that are appropriate for superficial injection or PLLA could be considered for the thickening of the overlying soft tissue envelope and blurring this mark.

6.9.3 Injecting Techniques

For mild-to-moderate tissue laxity that worsens the groove, highly elastic filler materials could be injected deeply to reinforce the base of the ligament and buttress the overlying tissue up. This deep-lying strong filler could improve the malar groove by changing the scenario of descending tissues (**Figure 6.43**). In younger cases of malar groove, the reasons are usually the tightness of the ligament and the relative bulging of soft tissue next to it. Strong filler reinforcement can help this to only a very limited extent.

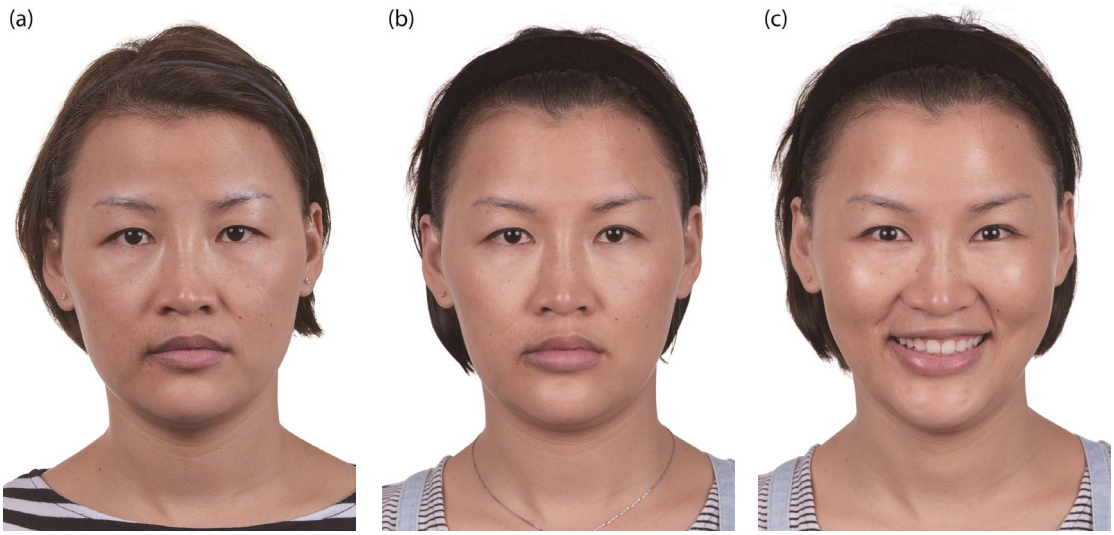

FIGURE 6.43 (a) The flat profile and lack of anterior facial projection for this young female patient is further complicated by the malar groove. (b) Restylane Volyme is used for cheek augmentation and deep support for the malar groove. (c) The result shows good dynamic stability one month after the injection and reasonable supportive efficacy.

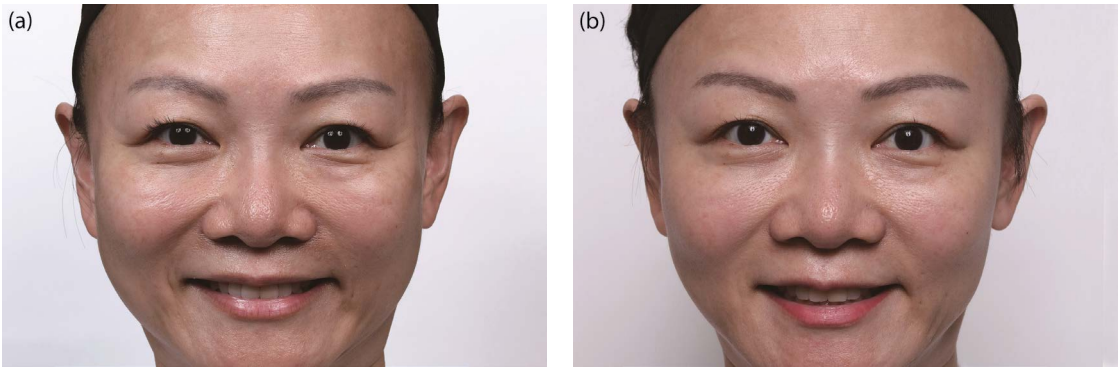

FIGURE 6.44 (a) The malar grooves in patients with sufficient cheek volume can be addressed with superficial approaches. Malar grooves often look more prominent under the excursion of elevator muscles. (b) Delicate layering of PLLA in the superficial fat tissue with enough peripheral feathering thickens the local superficial structure and well camouflages the groove.

The modification of superficial skin to camouflage the groove is another option. But the injection must be done artistically with minimal dosage and good feathering (**Figure 6.44**).

6.9.4 Cautions

Filler that shows a creeping tendency or is low in elasticity is not the filler of choice to accomplish this task. Soft fillers are usually too soft to resist the overlying pressure and are then forced to stay in the upper or lower compartments and further worsen the problem. HA fillers with a swelling tendency should be avoided in this region.

6.9.5 Clinical Effect and Limitations

Malar grooves are not always easy. Fillers can help improve the problem more in appearance than in structure; and overaggressive placing fillers often volumizes bilateral compartments and worsens the problem further (**Figure 6.45**).

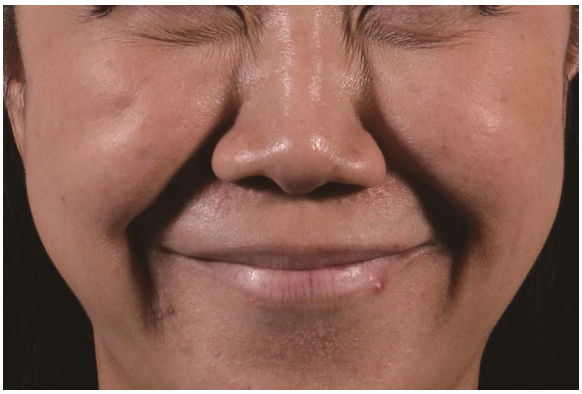

FIGURE 6.45 Inappropriate selection of filler products and poor techniques may deliver the filler material into the compartments above and below, further aggravating the bulging of the bank above and below and worsening the problem.

6.10 "CHEEKBONE" (MAXILLA AND ZYGOMATIC BONE COMPLEX, ALSO TERMED MALAR BONE COMPLEX)

The so-called cheekbone area is the anatomic area between the lateral infraorbital area and the buccal area. Its basis is formed by the medial aspect of the zygomatic bone and by the lateral aspect of the maxilla. It contains parts of the SOOF and the deep lateral cheek (DLC) fat compartment. It is transversed by the zygomaticus minor and major muscles and by the transverse facial artery. The prominence of this area influences the O-G curve and is a major determinant for facial attractiveness.

6.10.1 Frequently Encountered Problems

This prominence has a very different appearance in males and females. It loses dimension and supporting capacity with age in some patients. The optimal shape should not be an average or magic number in a ratio but a proportion balanced to the patient's entire face and the neighboring structures. Clinically, there are more male and aging patients who need structural augmentation. Asians and female patients tend to have wider faces and are more likely to request camouflage for over-prominent cheekbones. The transition above, medially, and below is important for facial elegancy.

6.10.2 Selection of Fillers

This area represents the stronghold of the zygomatic bony prominence. Fillers with reasonable elasticity should be better at the role of augmenting this shape (**Figure 6.46**). PLLA could also be used as for stimulation, deeply transforming the framework contour (**Figure 6.47**). Most of the fillers on the market can be used for softening the bony prominence by different techniques.

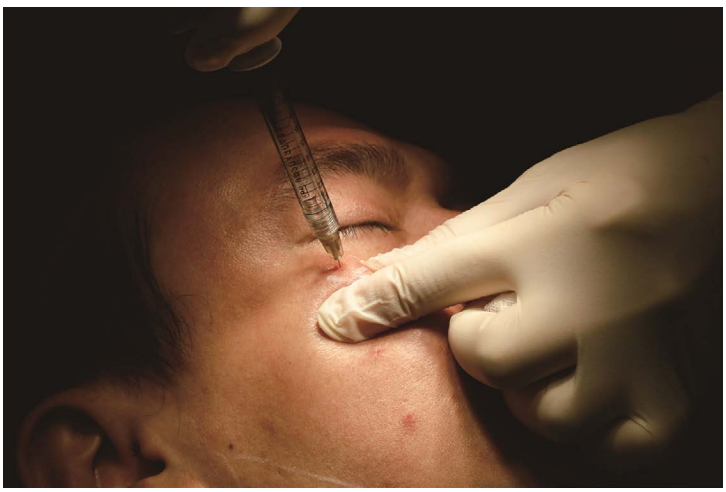

FIGURE 6.46 HA fillers can be used for the augmentation of the cheekbone to mimic the bony shape by a deep bolus depot injection. Juvederm Voluma is used in this middle-aged male and injected more in the superior facet. Note the empty space in the anterior part of the syringe formed due to full aspiration.

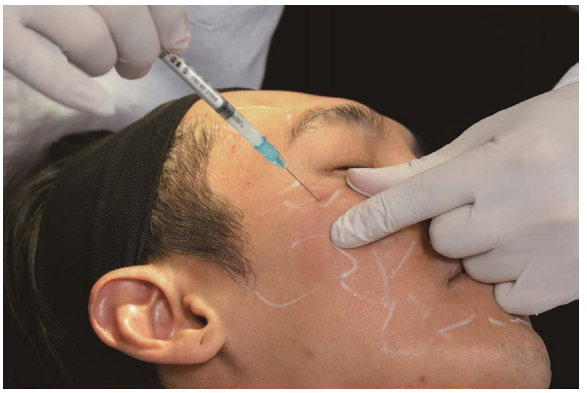

FIGURE 6.47 Sculptra is used in this younger male for the augmentation of the cheekbone in a superior lateral direction. The bolus depot technique is typically used for the deep injection of PLLA to have fixed neogrowth that mimics the shape of bone structure. Aspiration is mandatory; and the bolus should be adapted to the local requirement in varied sizes.

6.10.3 Injecting Techniques

Fillers intended for bony augmentation should be placed to mimic the shape of that bone. Stronger HA can be deposited as a deep bolus. CaHA, PLLA can be manipulated in the same pattern while CaHA and more cohesive stronger HA fillers can be used in a parallel linear pattern as well.

6.10.4 Cautions

Cheekbone definition does not mean the cheekbone dimension. Western faces with a narrow configuration sometimes need both, but cheekbone augmentation should be carefully crafted, without further widening Asian faces (**Figure 6.48**).

FIGURE 6.48 Cheekbone augmentation is the volume enhancement of the zygomatic arch. The zygomatic bone provides a fundamental support of the midface and the basic structure of the face. Augmentation can be done according to the patient's personal requirements in different direction to increase the facial dimension, projection, and apparent ridge shape: augmentation in the C direction is less required for the Asians because of their wide facial format; B is often required for midface structural weakness, whereas A is often indicated for aged patients to give more shape and support.

6.10.5 Clinical Effect and Limitations

Cheekbone augmentation is volume- and cost-effective. It restores the orbit in a more low-key way. Soft fillers could not last long at this point. Symmetry and artistry should be emphasized. Pattern and dose should be judged carefully, avoiding artificiality.

6.11 MEDIAL AND LATERAL CHEEK

The medial and the lateral cheeks comprise the anatomic area lateral to the nose. It is majorly affected by age-related changes, as the underlying bone and the overlying soft tissues undergo substantial transformation during a lifetime. The underlying bone is affected by bone remodeling and recedes over time. Similarly, the height of the midface decreases over time, which causes the overlying soft tissues to descend. The descent in midfacial soft tissues mimics a loss of volume that is, however, only a partial cause of the age-affected midface. An inadequate strategy to restore a youthful face would be to volumize this region instead of lifting and repositioning the midfacial soft tissues. Relative volume changes with age and does not always proceed as reduction. More and younger patients ask for cheek enhancement because of suboptimal contours regardless of loss or even insufficiency. Filling with fillers where it looks deficient might not always be a success in patients with aging-related tissue descent. Anatomical knowledge gives us understanding of the reasons behind different morphological problems, not a map to fill something back in where the depression originates.

6.11.1 Overview of the Anatomy

The midface can be split into three vertical regions from lateral to medial: the parotideo-masseteric, buccal (both lateral midface), and the central (medial) midface. The parotideo-masseteric region includes skin (layer 1), subcutaneous fat (layer 2, middle and lateral cheek fat), SMAS (layer 3), deep spaces (layer 4), and parotideo-masseteric fascia (layer 5). It extends from the auricle to a vertical line at the lateral margin of the bony orbit. The parotid gland, the masseter muscle, and branches of the facial nerve are located deep to the parotideo-masseteric fascia. The buccal fat pad (fat pad of Bichat) is located beneath the masseter muscle within the masticatory space. It is bordered anteriorly by the facial vein that travels superomedially within the facial vein canal. Notably, facial nerve branches such as the marginal mandibular, buccal, and zygomatic nerves emerge beneath layer 5 and travel in a medio-anterior trajectory within fibrous connective tissue sheets connecting to the SMAS medially. The SMAS is a three-dimensional (3D) complex of fibrous collagenous tissue, intrinsic musculature, and fat separating the superficial fat compartments from deeper layers. It is continuous with the superficial temporal fascia, the orbicularis oculi muscle, and the platysma. This fascial sheet carries important biomechanical properties and transmits movements of the underlying muscles of facial expression to the skin. Layer 4 contains the inferior, middle, and superior premasseteric spaces. The superior premasseteric space contains the transverse facial artery. It provides a branch for arterial blood supply of the overlying SMAS traveling within the zygomatic ligament (also known as McGregor's patch). The parotid duct is located between the superior and middle premasseteric space, beneath the parotideo-masseteric fascia.

The buccal region is composed of six fascial layers, including skin (layer 1), subcutaneous fat (layer 2, jowl fat compartment), SMAS/platysma, (layer 3), buccal space (layer 4), buccopharyngeal fascia (layer 5), and the buccinator muscle (layer 6). The facial artery travels through the buccal space. This space is located anterior to the masticatory space (which contains the buccal fat pad). The facial vein canal borders posteriorly.

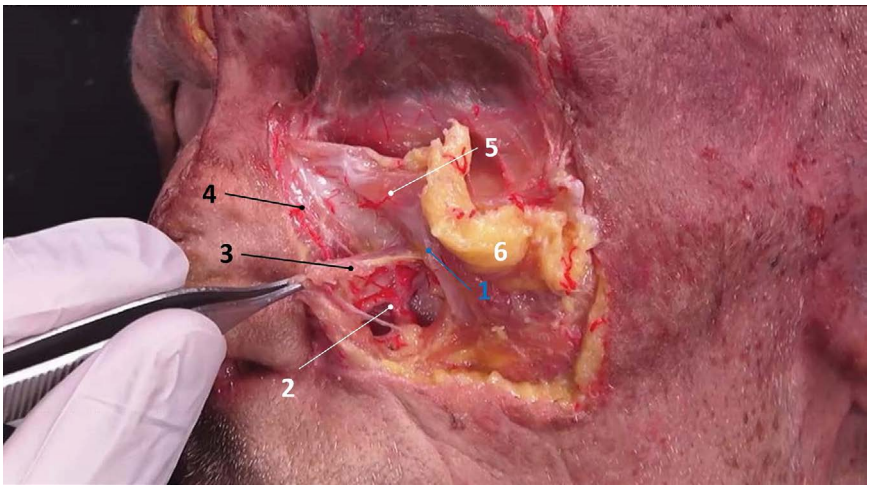

FIGURE 6.49 Cadaveric dissection of the left midface. The facial vein (1) is located in the depth of the nasojugal groove. The infraorbital neurovascular bundle (2) emerges from the infraorbital foramen in the depth; (3) LAO (levator anguli oris); (4) LLSAN (levator labii superioris alaeque nasi); (5) orbicularis oris muscle; and (6) SOOF.

Seven distinct layers make up the central midface, including skin (layer 1), subcutaneous fat (superficial nasolabial and medial cheek fat compartment, layer 2), SMAS/orbicularis oculi muscle (layer 3), deep nasolabial fat (layer 4), LLSAN muscle (layer 5), deep pyriform space, as well as deep medial cheek (DMC) and DLC fat (layer 6), and periosteum (layer 7). The deep fat compartments are separated by neurovascular bundles, muscles, or ligamentous structures (**Figure 6.49**). The deep nasolabial fat lies on top of the LLSAN. The deep pyriform space is located most medially, beneath the LLSAN and medial to the infraorbital foramen where the infraorbital neurovasculature emerges (**Figure 6.50**). The DMC is bordered by the infraorbital neurovasculature medially and the angular vein laterally, while the angular vein is the medial boarder of the DLC. Laterally, the DLC is bordered by the zygomaticus major muscle, which originates from the zygomatic bone and travels anteriorly in an inferomedial trajectory from the depth to

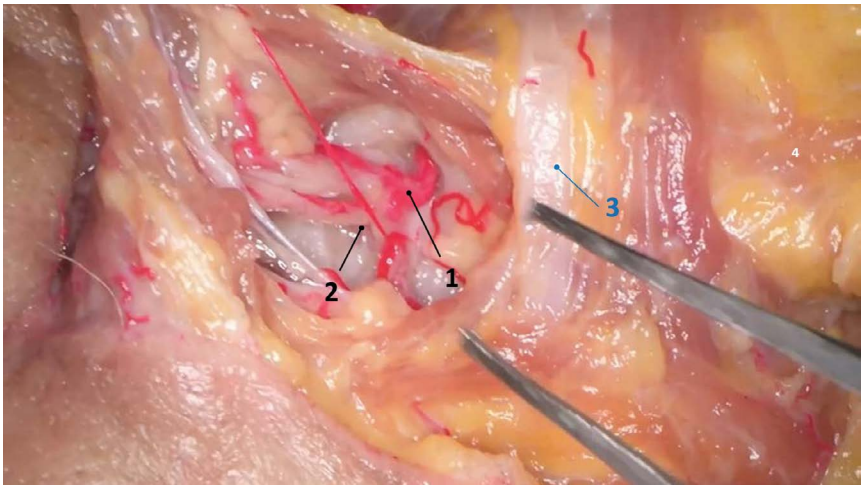

FIGURE 6.50 Cadaveric dissection of the left infraorbital area: a close-up view of the infraorbital artery (1) and nerve (2) emerging from the infraorbital foramen; (3) facial vein; and (4) SOOF.

its insertion point at the modiolus at the angle of the mouth directly beneath the skin. The zygomaticus major muscle is connected to the maxilla via the transverse facial septum. The zygomatico-cutaneous ligament forms the superior border of both DMC and DLC. The zygomatic ligament (McGregor's patch), part of the line of ligaments separating the medial from the lateral face, is located in proximity to the origin of the zygomaticus major muscle. Branches of the facial nerve can be found deep to the SMAS. The angular artery travels cranially lateral to the nasolabial sulcus. It can be found at variable depths; however, the distance from the nasolabial fold is highest at the nasal ala and smallest at the oral commissure.

6.11.2 Frequently Encountered Problems

Morphological problems of the cheeks usually result from the underlying craniofacial platform. The midface bony structure could present as a flat front, with protruding maxillary alveolar ridge, maxilla and mandibular underdevelopment, or skeletal discrepancy such as orthodontic classes II and III. The soft tissue overlying the bone then appears as deficiency or redundancy because the space structured by the bone is overdeveloped or underdeveloped.

The relationship between stratified fat compartments and muscles of the cheek is more complex than in other facial areas. The deficiency of either layer of a compartment that is roughly divided by the SMAS layer could result in deflated appearance, unevenness, or depression. Deficiency of the superficial subcutaneous fat tissue means there are fewer buffers below the skin; the shape of muscles, gaps, and ligaments then becomes visible. The deep fat compartment of the cheek finishes inferiorly at the level of the zygomaticus major. The lateral cheek structure is also devoid of deep fat stuffing except for the bellies of the masseter muscle. When patients show a deficiency in the lower or lateral cheek that needs augmentation, the filler can be more appropriately put in the superficial layer or across layers in the lower cheek to appear natural dynamically. Ligament marks and gaps between muscles are tricky. Volume overfilled could further worsen these breaks (see **Figure 6.45**); volume filled superficially must be extremely neat and even to avoid visible errors upon muscle contractions.

6.11.3 Selection of Fillers

The cheek is the area where almost every filler can be used. As most of the cheek tissue is soft, HA is probably the most popular filler being used here. PLLA was used in the very beginning for HIV patients with lipoatrophy, who are extreme cases with severe cheek fat deficiency. PLLA was used to augment their large volume loss and is now believed to be the choice for severe deficiency. However, PLLA could be precisely exploited in the cheek whether for specific faults or merely for contour enhancement. CaHA was recently popular for its biostimulating applications in the superficial layer of the subdermal plane in order to strengthen soft tissue structure in addition to providing new volume. CaHA, when used as a volumizer, is similar to some stronger HA fillers and targeted for certain areas instead of for full cheek filling.

6.11.4 Injecting Techniques

HA fillers with softer texture can be injected in a larger bolus for molding to fit the contour requirement. This practice is easy in technique but is potentially give suboptimal results when tissue integration is not good enough.

The concept of tissue integration relies on there being enough tissue to integrate the filler. When the volume deficit is large, beware of putting HA in different layers to achieve the final target.

Deep layer placement with big depots could be risky as well. The prezygomatic, premaxillary, masticatory, and buccal spaces and so on are reserved for muscle movements and are relatively loose. Gel-form fillers could slide within these spaces when being compressed together and descend with gravity, as they

FIGURE 6.51 (a) The injection of PLLA in midface is very flexible in direction, depth, pattern, and in amount. For the different purposes of cheek enhancement, needles can be better for flexibility and easier access to different tissue points. Gaps in tissues present in certain parts of the cheek. Injection should be targeted directly to that point delivering the PLLA in a bolus. (b) The deep fat compartment should be addressed with the help of a guiding finger, with multiple boluses in smaller sizes according to thickness of local soft tissues. (c) The lower cheek can be augmented in the superficial subcutaneous layer and is preferably treated by the fanning technique. (d) PLLA can be injected in a more superficial layer for some fine adjustment or the purpose of skin quality. Injection should be delicate in a fan pattern with a minimal amount of the agent per pass.

are unstable in shape. Multiple parcels with partitions should be considered when an HA filler is being injected.

PLLA can be used according to pathognomonic reasons and placed deeply for its larger amount and mechanism of self-tissue growth. Needle injection is the best way to deliver a liquid-form substance with better precision and flexible tailoring according to the structural requirements and the amount of deficiency (**Figure 6.51**). The cannula was popular in some groups to avoid PLLA needle clogging and bleeding but has resulted in many cases of asymmetry and lumpiness because the flow of a liquid through a cannula can hardly be continuous and steady.

CaHA, when intended for focal structuring or contouring, should be diluted for better malleability and more refined distribution. 3D-like structuring is a useful skill here, adapting to local contours. Biostimulation using diluted or hyper-diluted CaHA should be injected with a cannula for better safety. The blunt tip of a cannula sliding or scraping along the rather rigid dermis in a reverse pattern should ensure the rather thin material is deposited in the same layer and placed evenly.

As stated previously, the mobility of the superficial midfacial fat compartments must be considered when injecting. Studies have demonstrated that the superficial fat compartments are of great importance during facial expressions such as smiling, as they contribute majorly to facial mobility. Injection of soft tissue fillers into these compartments could limit mobility during speech and expressions or increase

inferior descent of the compartments due to high mobility. Midfacial volumization procedures should rather focus on reestablishing age-related volume loss within the deep fat layer through supraperiosteal injections.

A multiple layer approach is necessary when multiple problems present or when the volume deficit is large.

6.11.5 Cautions

There are no standard protocols for successful cheek treatment. Every patient should be carefully evaluated by visual observation and hand palpation. Facial muscle movements can help to locate the muscle insertion points and delineate the underlying structures. Pinching the facial soft tissue and pressing upon the bone should help the injectors determine the bony shape and thickness of soft tissues in different regions.

6.11.6 Clinical Effect and Limitations

Soft tissue loss is the ideal domain for soft tissue fillers. However, fat tissue, muscle, and the intercellular matrix of self are tightly bonded with each other as they grow together. Fillers in tissue can only interact with tissue with finite affinity. When the quantity of filler is greater, the affinity with tissue might not be strong enough to ensure all the mixture reacts and moves coherently under the impact of external pressure and shearing forces (**Figure 6.52**).

Superficial fat deficiency is not easy to reverse thoroughly and evenly. A biostimulating agent is promising to improve this situation with additive fibro-supportive neo-tissue formation, although in some areas the deficiency occurs too superficially (**Figure 6.53**).

The descending laxity of tissue resulted in a cascading appearance and contour deficits. When fillers are used in this scenario, they should be injected with caution. Any hollowness that disappears when patients are lying down should not be overcorrected through volume augmentation; this kind of deficiency is just relative and mobile under gravity. Enthusiasm for fillers being used for every morphologic problem could create more problems because volume only plays a part in the whole aging scenario. In particular, overfilling the cheeks should be avoided at all costs. The reason for this is the functional anatomy of the face that mainly shows in the midface.

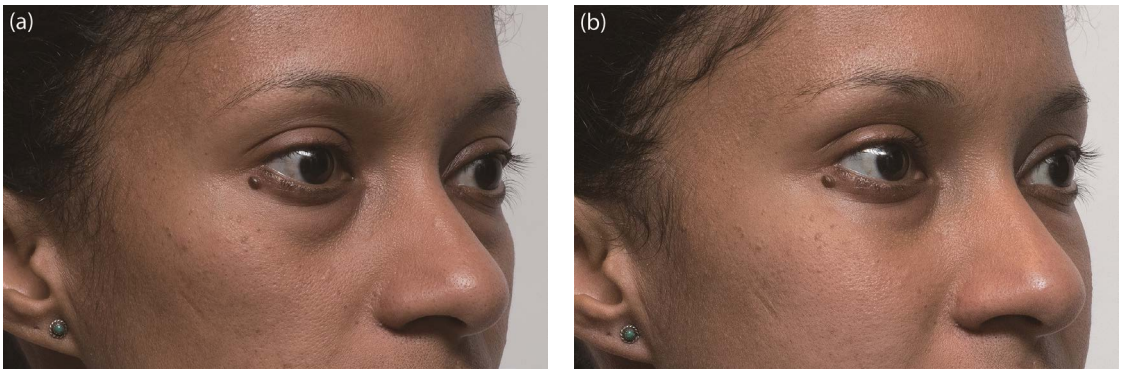

FIGURE 6.52 (a) Volume deficiency is obvious in this black female patient both in the superficial and the deep layer. (b) Belotero Intense was used in this patient for deep augmentation by cannula injection and also Belotero Balance by cannula for the superficial layer. The after photograph shows homogeneous fullness compatible with her age and a natural transition to the unfilled original structures.

FIGURE 6.53 (a) Minor gaps of the face should be addressed better at the superficial layer but the techniques for superficial injection are more challenging for injectors. Superficial injection with PLLA is even more difficult than with the linear fillers. This young female has enough facial volume but suboptimal curves and minimal gaps and depressions below the eye and around the mouth. That is a quite typical case in Asia for requests for PLLA treatments. (b) Superficial layering of the PLLA relies on a delicate fanning technique that evenly covers the cheek to the infraorbital area. The change one year after the injection shows homogeneous fullness with sharp curves, firmer skin, and a glow. The infraorbital improvement is prominent and natural.

The transverse facial septum is an important structure with clinical implications when performing filler injections. It originates from the underside of the zygomaticus major muscle and attaches to the maxilla deeply. It forms a transversely running, vertically oriented boundary between the buccal space inferiorly and the DMC and DLC fat compartments superiorly. Due to its attachments to the zygomaticus major muscle, this ligamentous adhesion changes position dynamically during muscle contraction (i.e., smiling), resulting in a superior displacement of the midfacial fat compartments, thereby shifting the point of maximal midfacial anterior projection cranially. This effect may be enhanced after application of soft tissue filler in the midface, resulting in the facial overfilled syndrome (also referred to as "apple-cheeks"), which is why dynamic filling and injecting of filler, while asking the patient to smile repeatedly is suggested.

6.12 LOWER CHEEK (ALSO TERMED THE BUCCAL AREA)

The lower cheek is continuous with the mid-cheek face (superiorly) and is bordered inferiorly by the jawline. In the lower cheek, no stable bony fundament can be found as the deepest layer is formed by the oral mucosa. Therefore, this area is highly mobile and contains predominantly fatty tissue.

6.12.1 Frequently Encountered Problems

The lower cheek hangs down with borders partially attached with firm structures. Hanging tissue appears saggy when structures weaken with age. The loss of bony support above in the midface results in soft tissue laxity of this area, which in advanced stages presents clinically as sagging. However, the absence of bony support is one of the reasons why some younger patients request treatments for similar problems in the lower cheek. An idiopathic underdeveloped maxilla or mandible has the same amount of soft tissue hanging from a smaller frame, which appears crowded and disproportionate.

Bulging, sagging, grooves, and depression are connected with tissue laxity, descent, and volume changes. Many of these problems rely on treatments of the neighboring tissues of the midface, lateral cheek, chin, and jawline.

6.12.2 Selection of Fillers

Filler in this area has to stay superficial due to the high mobility of this anatomical region. HA with more fluidity and a creeping tendency should be excluded from this indication as it would increase the absolute weight and could increase sagging. PLLA could perform well when being distributed evenly in these soft tissues as the new fibrotic tissue will be tightly bounded with the original; tissue tightening is part of the expected biostimulating effects. CaHA shows a good result with diluted schemes when being layered superficially.

6.12.3 Injecting Techniques

HA fillers for thin subjects should be avoided as a large bolus because the lower cheek wall is rather thin and equipped with highly mobile mimetic muscles. PLLA injection should be injected across layers of tissue, avoiding a large bolus, to maintain natural soft tissue texture and normal dynamicity. CaHA is suggested to be employed in a more diluted form in a 3D structuring pattern or by a superficial subdermal layering technique to fit better the local structure and dynamicity.

6.12.4 Cautions

Shadows and grooves of the lower cheek due to tissue laxity could appear different in a supine and upright posture. Injection practices focusing on the depression could target the problem wrongly and further increase the burden of sagginess.

6.12.5 Clinical Effect and Limitations

Lower cheek treatment should target not only the cheek soft tissue itself but the supporting structures above and below. The laxity problem can only be partially improved by injection but not by inflation. The uneven surface could be camouflaged by injection but the insertion of filling materials should respect the original tissue orientation and tissue mobile patterns (**Figure 6.54**).

FIGURE 6.54 The augmentation of the chin should also cover the area of para-chin to ensure an integral lower face structure. (a) Restylane Lyft is used in this young female for chin augmentation via a gradient needle bolus injection and tower technique. (b) The after photograph 2 weeks after treatment shows good integration with tissue under the pulling of muscles.

6.13 NOSE

Though injectable nasal augmentation is one of the most requested procedures – especially in Asia – it is very risky regardless of what instrument and materials are used for the injection. The high risk results from the close proximity of the nasal arterial system to the ophthalmic artery circulation. The lateral nasal, the dorsal nasal, the angular, and the septal arteries are all connected to the ophthalmic artery circulation and can transport intra-arterial materials to the eye. Careful selection of the patient and careful injection should be mandatory.

6.13.1 Overview of the Anatomy

The external nose consists of the nasal bone, the upper lateral cartilages – separated by the dorsal septum – and the lower lateral cartilages, which can further be divided into a left and right medial and lateral crus. The mid-nasal dorsum shows a classic five-layered arrangement, including skin (layer 1), superficial fat (layer 2), nasalis muscle (layer 3), loose areolar tissue (layer 4), and perichondrium (layer 5) (**Figure 6.55**). This layered arrangement cannot be found at the nasal radix or tip. At the nasal radix, the layered arrangement is lost due to the procerus muscle that courses obliquely from the nasal bone to its dermal insertion in the glabella region. The nasal tip is composed of homogenous fibrofatty tissue spanning from below the skin to the alar cartilage perichondrium, which corresponds to the fusion of the subcutaneous fatty layer and the loose areolar tissue more cranially. Although the majority of the nasal arterial vasculature is located within the superficial plane, it is notable that in a significant amount of cases, it can travel within deeper layers at the nasal radix and at the mid-nasal dorsum. The vascular supply originates from the supratrochlear and dorsal nasal artery cranially (both terminal branches of the ophthalmic artery). Branches of the angular artery provide blood supply to the nose caudally.

6.13.2 Frequently Encountered Problems

Problems of the nasal outward appearance that could be largely corrected by injectable fillers include the height and level of nasal radix, the height, and the contour of the nasal dorsum; partially improved

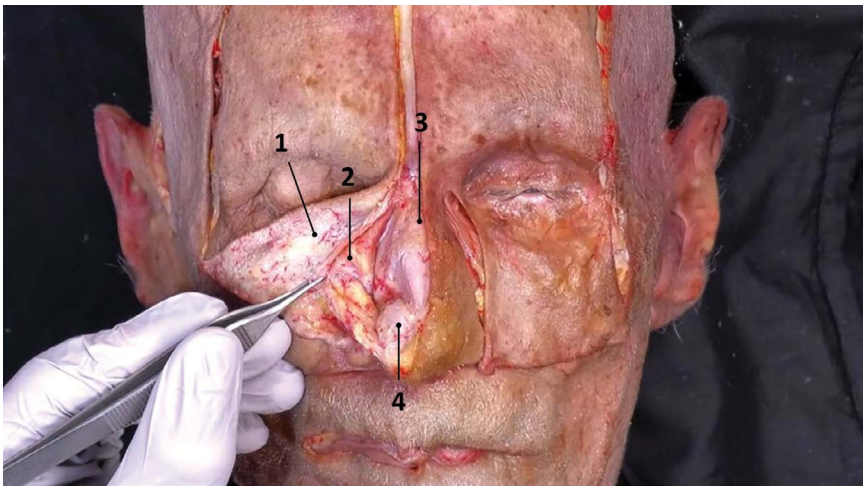

FIGURE 6.55 Cadaveric dissection of the nose. At the mid-nasal dorsum, a typical five-layered arrangement, consisting of skin (1), superficial fat, nasalis muscle (2), loose areolar tissue, and periosteum (3), or perichondrium (4) can be found.

problems include nasal length, nasal tip projection, and rotation, symmetry, and deviation. For a bulbous tip or wide nose, or when nasal skin is not extendable, filler injection would be of limited use.

6.13.3 Selection of Fillers

The shape of the nose is mainly determined by the underlying rigid structure of bone and cartilage. Fillers can be capable of changing the shape of the nose if they are strong enough to mimic the consistency of the bone or cartilage.

6.13.4 Injecting Techniques

Though a cannula has always been said to be safer than needles for nose filler injection, complications of necrosis and blindness from cannula injection have been reported. Needle injection, directly piercing through the skin with bevel down to avoid intravascular injection, still bears the risk of vessel disruption. For the prevention of intravascular filler injection, when a needle is employed, there should be good illumination for better examination of the underlying vessels. Injectors should palpate the injection zone to discern pulse location. Squeezing can be considered during the injection with the guiding fingers collapsing intervening vessels. The injection should touch the bone to ensure it is at the deepest level. Bevels should be turned down to lessen the possibility of opening into the vascular lumen. Deliver only small doses to avoid hydrostatic overpressure and dwindle the scale if any problem seems to occur. Be more conservative when entering the nasal tip.

The cannula is adopted by some injectors on the nose via entry from the nasal tip. The rigidity of the cannula is hindered by the nasofrontal angle from the frontal approach. When an entry point is created on the nasal tip, it turns into a leaking point. Most nasal shape problems – nasal length, tip angle, tip projection, nasal height, and undesired shapes – are all closely related to the work done in the nasal tip. However, a break in the most pressure critical area would annul all the attempts to add volume in the tip (**Figure 6.56**). Although the cannula is blunt at the end, it could still penetrate vessels. A sensation of pain is usually a warning sign that vessels are being approached but the pain is rather prominent for the cannula insertion itself. The pain signal becomes nonspecific during the entire cannula nasal penetrating process. Aggressive cannula puncture carries greater risks of breaking a vessel but the blunt nature of the cannula when facing resistance, especially in a secondary procedure, necessitates more forceful application.

The plane of choice for both needle and cannula injections is the deep supraperiosteal or supraperichondral plane. This plane is in the midline of the nose and is mainly avascular, as the majority of vessels travel within the superficial (subdermal) fatty layer. An exception to this generalization is, however, the nasal tip and the root of the nose. At the nasal tip, no layered arrangement can be identified and the columellar, alar, septal, and sometimes the subnasal arteries form an arterial vascular network. Here caution is recommended as the local injection of soft tissue filler can cause compression of the vascular supply. At the root of the nose, the dorsal nasal artery can be identified either superficial or deep to the procerus muscle that increases the risk for intra-arterial product application even in the deep plane. Product applications should also be limited to the midline as at the lateral aspect of the nose, the lateral nasal artery connects to the terminal branch of the anterior ethmoidal artery in the deep plane. Here the deep plane again poses a risk for intra-arterial product application.

6.13.5 Cautions

There is no 100% safe injecting technique for the nose. Injectors have to be vigilant and always listen to the response of patients. There should be limited use of nerve block, local infiltration, or the procedure under general anesthesia or deep sedation. Softer gel without enough strength should be reserved for

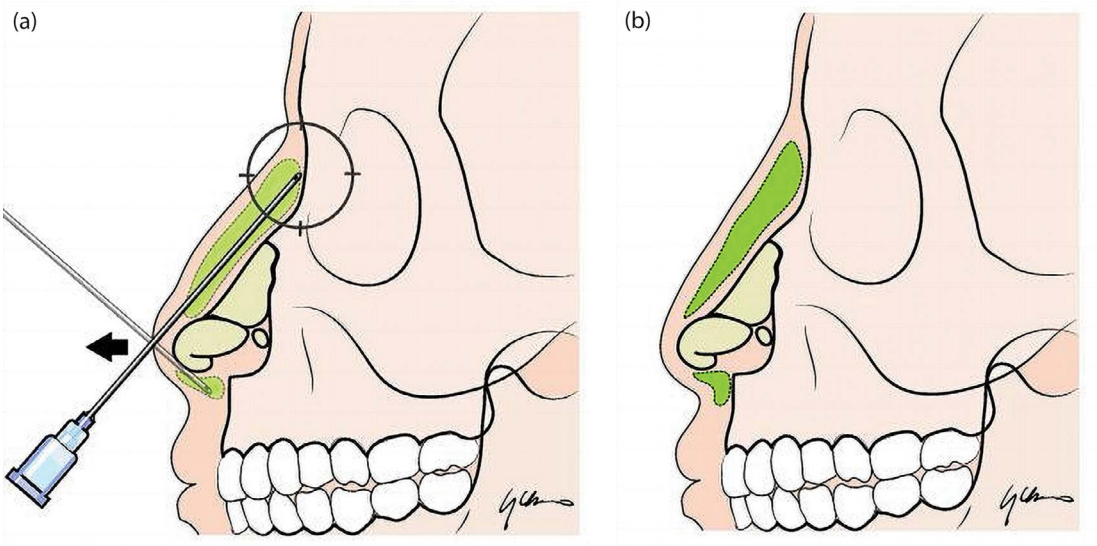

FIGURE 6.56 (a) A cannula injection of the nose often has its entry point created on the nasal tip. The cannula travels inside the nose along the cartilage and bone toward the nasal root and the nasal spine using the same hole. However, this entry hole that opens on the apex of the nose becomes a leaking point to release tension. In other words, filler is not able to stay at the tip when the opening is created on top of it. (b) The result of this technique leaves fillers distributed unequally – more on the root of columella and superior part of dorsum and less close to the tip. That interferes with the contouring purposes, especially for problems related to tip projection and nasal angles.

surface correction only or sidewall volume adjustment. Patients with past histories of trauma, surgery, implant, filler injection, or threading should be carefully handled because the pattern of vessel distribution and fibrotic tissue reaction could increase the risk of vessel injury (**Figure 6.57**).

FIGURE 6.57 Needle injection of the nose could limit the spread of filler material and achieve more precise augmenting results. Restylane Lyft is used in this young female for augmentation of the nasal dorsum. The bevel is directed to the bone. Injection is secured by enough aspiration. The injection process consists of retrograde pushing and the needle is kept moving during the whole process. Fingers of the guiding hand help squeeze the dorsal skin to elongate the route and collapse any possible vessels being approached.

FIGURE 6.58 The nasal profile should be considered part of the whole silhouette from forehead to mandible. (a) Restylane Lyft is used in this young female for correcting the problem of a concave midface by augmenting the nose from tip to index; Restylane Defyne is administrated on the brow, glabella, and paranasal fossa. (b) The picture one month after injection reveals better projection of the midface and a satisfactory profile. Restylane Kysse also ensures a better relationship of the lips because of the different measurement between the nose and the chin.

Although the majority of the nasal arterial vasculature courses within the superficial plane, the vascular course is variable and arteries can be present in the deep supraperichondral and supraperiosteal plane. Due to its proximity to the ophthalmic artery circulation, the nose is a high-risk region for soft tissue filler injections.

6.13.6 Clinical Effect and Limitations

Filler injection is the only foreign body tamponade inside the nasal soft tissue. Severe bony or cartilage deficiency or a considerable lack of dimension or projection can only be improved partially (**Figures 6.58** and **6.59**).

6.14 NASOLABIAL FOLD

Nasolabial fold filler injection is a very frequently requested procedure. The nasolabial sulcus is a normal facial contour that exists in almost everyone from childhood to old. Filler treatment of the nasolabial fold should aim to modify its pattern or depth, not to remove it, as what is considered undesirable is its senile

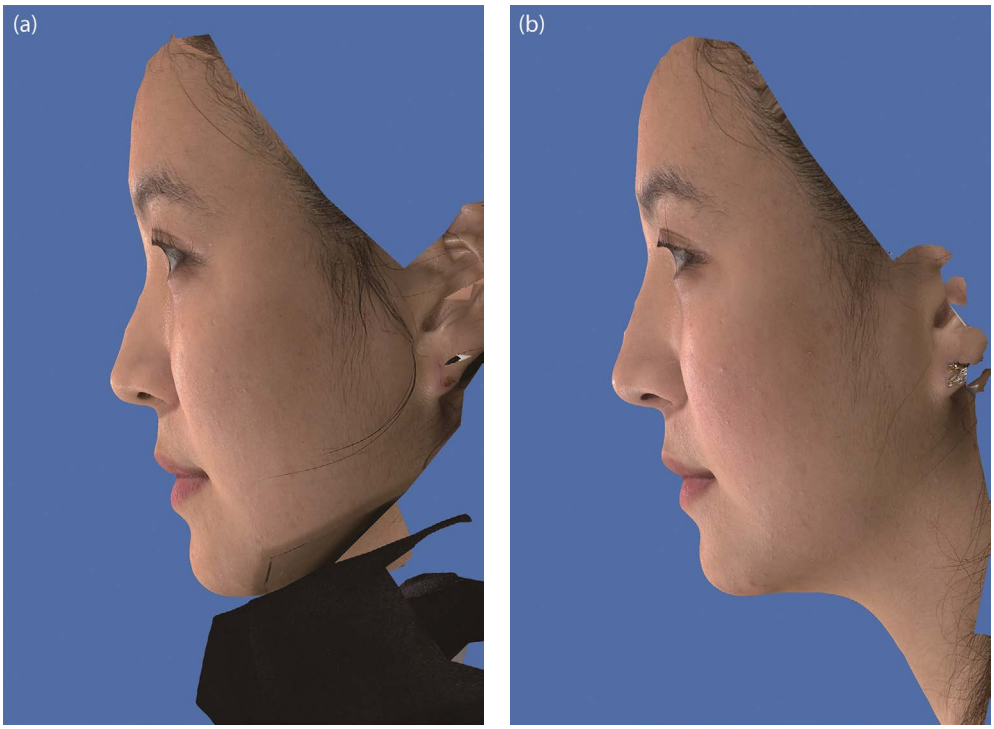

FIGURE 6.59 (a) One ml of the Taiwanese HA product Hydermis Chic is used in this young female for nasal augmentation. (b) The picture one month after treatment shows natural and prominent improvement in the projection, height, length, and straightening of the dorsum.

appearance, not the fold itself. The anatomic basis for the formation of the nasolabial sulcus is the dermal insertion of the LLSAN, zygomaticus minor, zygomaticus major, and levator anguli oris muscles. These muscles originate from the bone and travel superficially to reach the dermal undersurface. This insertion of muscles forms a natural boundary for the superficial nasolabial fat compartment that is one of the most mobile superficial (subdermal) fat compartments of the face. With increasing age and loss of bony fundament of the midface, the midfacial soft tissues descend. This descent, however, is blocked by the dermal insertion of the facial muscles, which causes the superficial nasolabial fat compartment to bulge above the sulcus, generating the clinical appearance of a deep nasolabial fold.

6.14.1 Overview of the Anatomy

The nasolabial sulcus – the strong linear dermal depression at the inferior boarder of the superficial nasolabial fat pad – is marked by a change in the subcutaneous architecture of the SMAS, the subcutaneous fat and skin. Lateral to the nasolabial sulcus, the subcutaneous tissue is referred to as Ghassemi Type 1 tissue, where fibrous septa enclose lobules of fat cells, compartmentalizing the superficial fat compartments with loose adhesions between the skin and the SMAS. Medially, the subcutaneous fat is composed of a dense collagen-muscle fiber network with interposed fat cells with strong adherence between skin and SMAS, referred to as Ghassemi Type 2 tissue. The sulcus becomes more prominent when age-related changes promote tissue laxity and inferior displacement lateral to the nasolabial sulcus. Age-related inferior displacement of the highly mobile superficial nasolabial fat compartment causes a pseudo-prolapse superficial to the nasolabial sulcus that increases its prominence.

6.14.2 Frequently Encountered Problems

Laxity of the midface soft tissue and the excessive nasolabial fat pad is the reason for a deformed nasolabial fold with a saggy upper brim. Nasolabial fold could be more prominent in patients who have retruded maxilla, hyperactive mimetic muscles that elevate the modiolus, or iatrogenic cheek puffiness. The curve of the cheek above the fold is equally important as its depth.

6.14.3 Selection of Fillers

Most fillers could work in this area with adaptive techniques according to their rheological and functional properties. Filler in most practices is injected in the superficial subcutaneous layer, camouflaging the fold instead of solving the underlying structural reasons. Injectors should be aware of that structurally there is no volume loss in the subcutaneous layer. Filler injection in this fold should be coupled with the treatments for midface volume and maxillary position. It is recommended to target the fold with lifting procedures first, focusing on the lateral and upper face (**Figure 6.60**).

6.14.4 Injecting Techniques

Either a cannula or a needle could be applied for strictly subdermal injection. Some injectors modify the superficial deployment of fillers into a fern-leaf or rail pattern crossing the fold for better structural mechanics and saving fillers (**Figure 6.61**). Multiple tiny puncture techniques at the dermal and

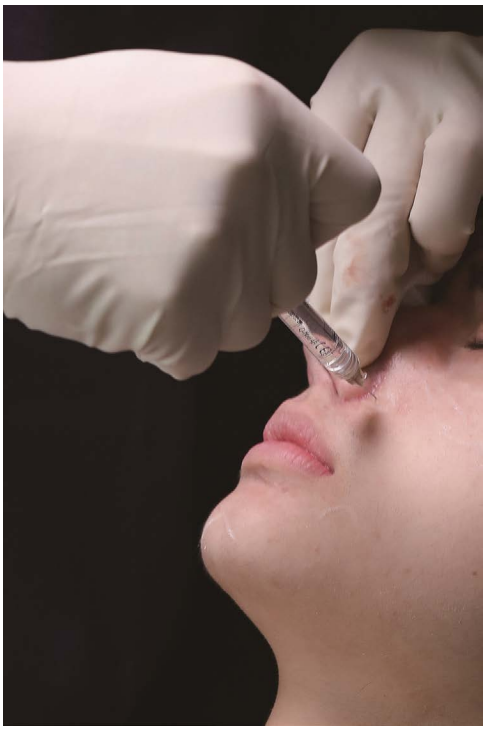

FIGURE 6.60 Augmentation on the paranasal maxillary bone could have the effect of improving midface projection and correcting the retrusive bony structure that predisposes the formation of a nasolabial fold. Restylane Defyne is used in this young female to improve the shadow in this area and the midface concavity.

FIGURE 6.61 Linear fillers are most frequently used in the nasolabial groove to fill the valley. Restylane Lyft is used here to camouflage this groove.

immediate subdermal level are also useful for adapting to the highly mobile nature of the area. With the use of needles, deep injection into the pyriform fossa can be performed. Here the product is administered into the deep pyriform space overlying the bone. Small amounts of product can improve substantially the appearance of the nasolabial sulcus. Another effect is that injecting into this space can narrow the width of the nose. In some cases, a deep angular artery can be identified in this area that can be encountered when preinjection aspiration is performed. If blood is visible in the needle hub, the injection should not be performed. If the plan is to inject the upper face first, this will involve amelioration of the nasolabial fold by injecting into the prezygomatic space of the SOOF, ultimately leading to repositioning the superficial nasolabial fat compartment in a cranial direction.

6.14.5 Cautions

Injection to camouflage should be modest and superficial; bony supporting injection should be deep and effective for lifting. Needle practice should involve aspiration and (certainly) use with the bevel down.

6.14.6 Clinical Effect and Limitations

Injectors and patients should be educated to avoid overenthusiasm to eradicate the fold. Treatment of the fold alone without balancing the neighboring structures could result in an awkward appearance.

6.15 LIPS

Lip enhancement is one of the most popular injectable procedures. As a free margin of facial soft tissue, the creation and augmentation here of curves, tubercles, and corners requires strategic spatial addition and arrangement of foreign substances. The filler and soft tissue complexes have to move with mimetic muscles, while also maintaining its selective fullness and distribution.

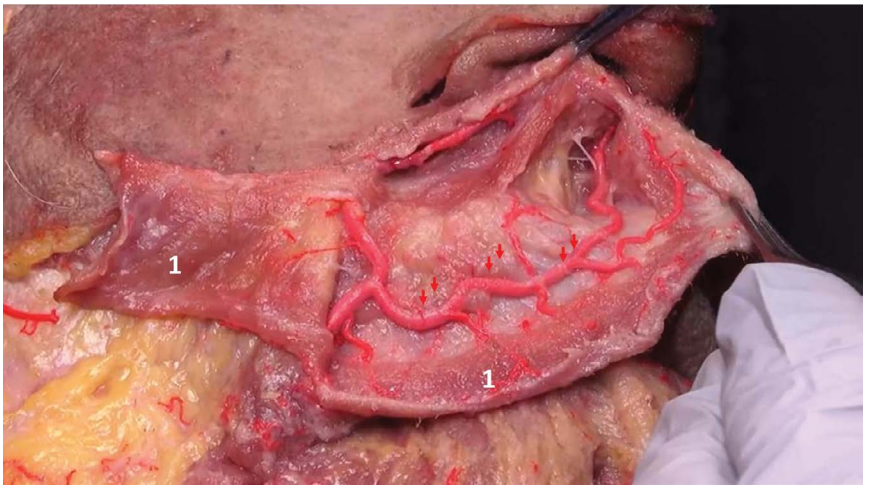

FIGURE 6.62 Cadaveric dissection of the upper lip. The superior labial artery (red arrows) courses within the submucosal plane, beneath the orbicularis oris muscle (1) in most cases.

6.15.1 Overview of the Anatomy

The lips are composed of skin (layer 1), orbicularis oris muscle (layer 2), and oral mucosa (layer 3). The modiolus marks the convergence point of the levator anguli oris, zygomaticus major, levator labii superioris, and depressor anguli oris muscles, as well as the platysma. The facial artery is connected to the modiolus by a muscular band of the buccinator muscle, positioned 1.5 cm posterior to the corner of the mouth. It is located deep to the converging muscles of facial expression, and superficial to the buccinator muscle in the depth. Inferior and superior to the modiolus, the facial artery gives off the inferior and superior labial arteries (**Figure 6.62**). The superior and inferior labial arteries travel within the submucosal space most frequently (~60%) followed by an intramuscular (~35%) and subcutaneous (5%) course. In addition, the arterial vasculature can predominantly be found within the vermillion (**Figure 6.63**).

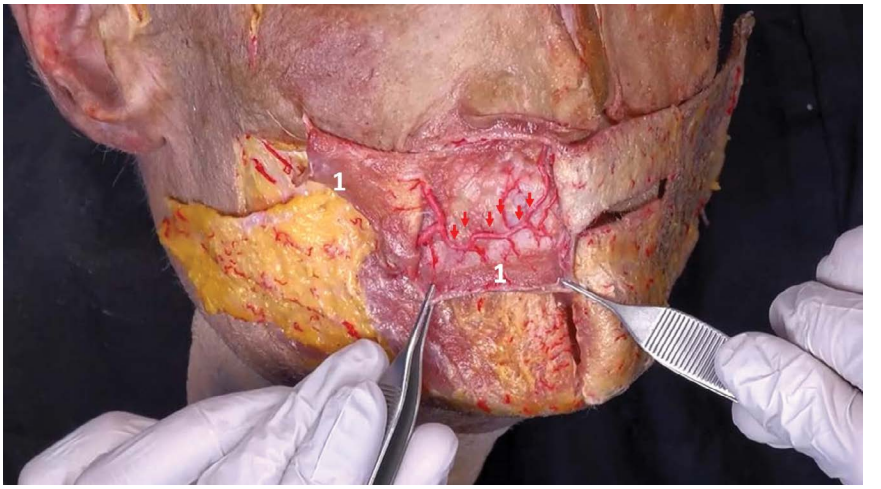

FIGURE 6.63 Cadaveric dissection of the upper lip. The superior labial artery courses within the submucosal plane, beneath the orbicularis oris muscle (1) in most cases.

6.15.2 Frequently Encountered Problems

Injection of fillers has been used to correct the problems of asymmetry, poor proportion (upper to lower, lip to face), inversion and eversion, biting pattern and dimension. Correction of any deficits should be more important than lip enhancement. Definition of the border, filtrum column, filtrum corner (**Figure 6.64a**), tubercles (**Figure 6.64b**), thickness and fullness, pouting and curve, mouth angle orientation, and cutaneous lip wrinkles or grooves could be enhanced or corrected by injection as well.

6.15.3 Selection of Fillers

HA is the filler of choice for lip work.

6.15.4 Injecting Techniques

The cannula has been used because of safety concerns but is less flexible and less delicate for details (**Figure 6.65**). The needle injection procedure consists of techniques of combined depot and retrograde linear threading, depending on the required shape of the volume.

6.15.5 Cautions

Both the superior and the inferior labial artery can be found in the majority of the cases within the lips in the deep submucosal plane. However, the artery can frequently change its plane and can be identified intramuscularly and subdermally. In the midline, the artery is always (= 100%) located within the red portion of the lip, whereas at the oral commissure it can only be identified in 80% of cases in the red portion. The labial artery transverses the lip closer to the mucosal surface, forming an arcade about the margin of the upper lip and at a distance from the margin in the lower lip, but can vary in different cases. Injection with cannula or needles should be performed carefully when the injection is at deeper layers.

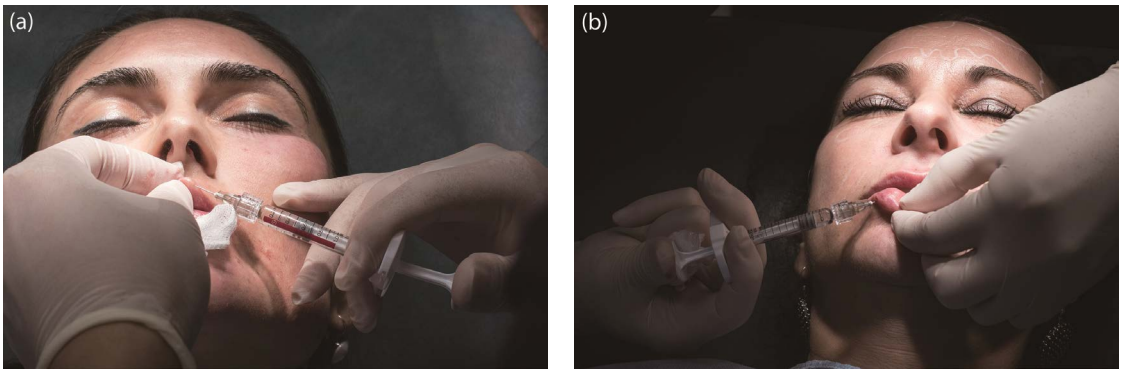

FIGURE 6.64 Linear injection along the vermillion border is a typical technique enhancing the lip shape. (a) Belotero Intense is used here for giving more pointed corner in this middle-aged Caucasian woman. Injection is about the level of the dermal subdermal junction. Lip tubercle creation and lip eversion could both be achieved by submucosal injection. (b) The dry access technique is used in another middle-aged Caucasian woman with a needle inserted out of the vermillion border. Belotero Intense is used here for a more well-formed tubercle because of its high cohesivity and reasonable elasticity.

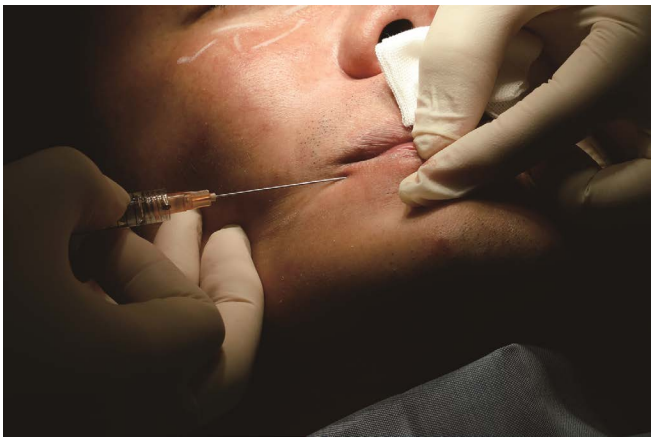

FIGURE 6.65 Cannula technique is used in this middle-age male to correct the problematic lip inversion with an entry point created below the mouth angle.

6.15.6 Clinical Effect and Limitations

Very soft filler when filled superficially could efface the fine wrinkle but give limited definitions. Tubercles (**Figure 6.66**), columns, or borders should be achieved with fillers with moderate strength. Asian lips should be addressed modestly (**Figure 6.67**). In Caucasian patients or those with very thin skin, the injector should refrain from superficial injection or big bolus deposition. Accumulation of HA fillers can be easily detectable throughout the skin. Fillers are best injected in the subcutaneous plane to avoid penetration of the arterial vasculature.

6.16 LABIOMANDIBULAR SULCUS (MARIONETTE LINES)

The labiomandibular sulcus is an area of great esthetic interest as its treatment influences not only the oral region but also the midface and the lower face regions. The sulcus is anatomically formed very similarly to the nasolabial sulcus: muscles of facial expression insert into the skin and form a natural boundary.

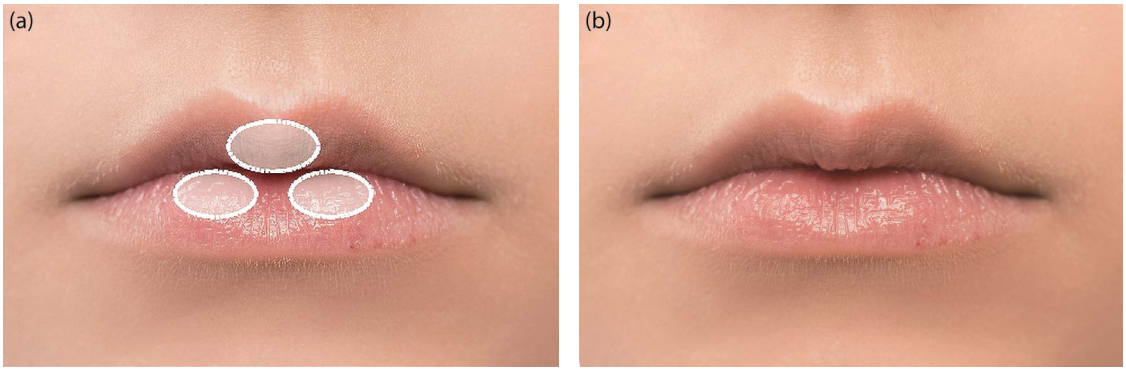

FIGURE 6.66 (a) The protuberances in the middle of the upper lip and next to the median in the lower lip are understood as the lip tubercle. (b) Along with the cupid bow and the filtrum, they make the lip more curving with young luscious fullness.

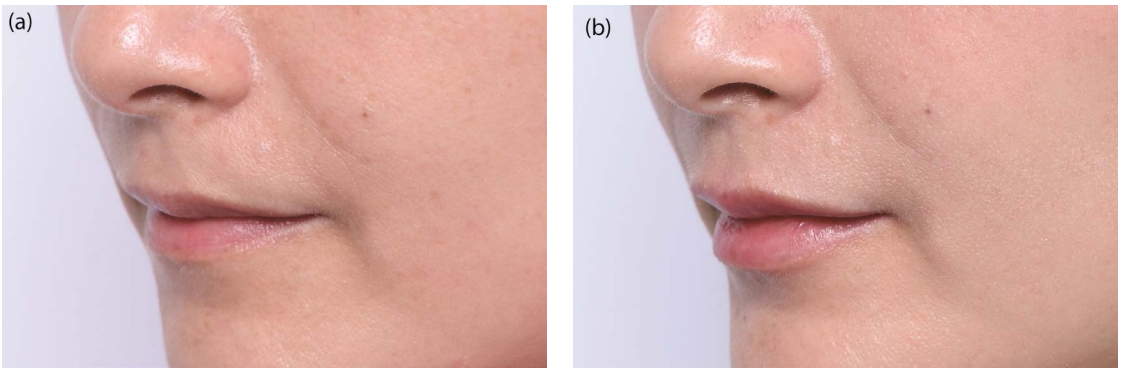

FIGURE 6.67 Injection for Asian lips should be modest. Injections should aim to restore a youthful pattern or create low-keyed eversion or tubercles. Belotero Intense is used in this mature female in mainly the lip tubercles and part of the borders (a) before (b) after the injection.

This natural boundary determines the jowl formation posterior to the sulcus and the depth of the pre-jowl sulcus anterior to it. Due to its close muscular interaction with the depressor anguli oris muscle, it affects the position of the corner of the mouth with an increased muscle tone resulting in its depression.

6.16.1 Overview of the Anatomy

Please refer to the anatomy described in the perioral region below.

6.16.2 Frequently Encountered Problems

Morphological problems of this area include a triangular depression that can increase a facial expression of sadness as the volume loss in the lateral lower infra-oral region results in the loss of support for the lower lip. Soft tissue descent of the inferior aspect of the superficial nasolabial fat compartment also results in sagging of the soft tissue lateral to the oral commissure. The saggy volume contrasting with the fibromuscular structure can increase the depth of the sulcus. Weakness and laxity of the perioral soft tissue would appear like many radiating wrinkles and grooves perpendicular to the vermilion border. Lines follow the pulling direction of depressors during smiling.

6.16.3 Selection of Fillers

Unevenness in this area could be camouflaged with HA fillers indicated for superficial use. Fillers for the grooves counteract the sagging tissue and have to be of certain lifting capacity (**Figure 6.68**). Bony structure augmentation, when indicated, is preferentially finished with fillers with higher elasticity. Mouth corner adjustment is better accomplished with HA fillers (**Figure 6.69**). Biostimulating agents can be employed to correct tissue laxity.

6.16.4 Injecting Techniques

The soft tissue in the infra-oral area is rather complex and stratified with muscle layers. Camouflaging injection for a labio-mandibular groove can be similar to the technique for the nasolabial fold. However,

FIGURE 6.68 HA filler can be applied to the marionette line in a similar pattern as that for the nasolabial groove. Juvederm Voluma is used in this young female to correct the prejowl shadow.

pulling on the lower cheek tissue by muscles calls for HA fillers with better cohesivity, good tissue integration ability, and extensibility. Fillers for improving cheek soft tissue quality are better delivered with a cannula in the subdermal layer.

6.16.5 Cautions, Clinical Effect, and Limitations

Filler injection for correcting the uneven surface is camouflaging rather than augmentation and should adapt to the local topography. Filler injection for descent or fat pad-related grooves can only improve the discrepancy, rather than eradicate it. Biostimulation improves quality but cannot help the problem of tissue redundancy (**Figure 6.70**).

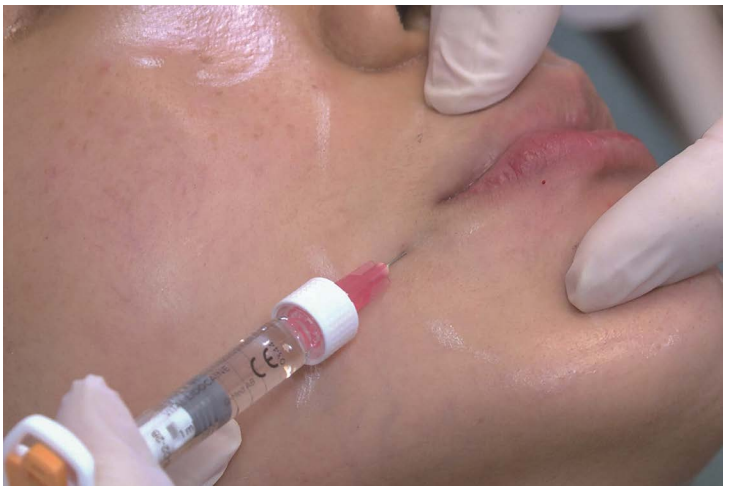

FIGURE 6.69 Mouth corner elevation can be achieved by the insertion of an HA filler below the corner. The lip is a soft tissue with free edges. Soft tissue fillers that stack below the corner can exert a little pressure on the soft tissue. Restylane Skinbooster is used in this young female for this effect.

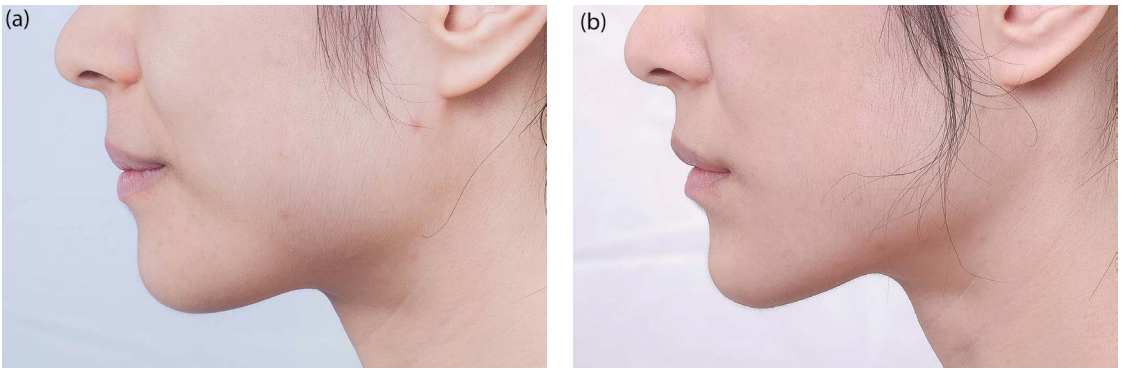

FIGURE 6.70 Ellanse S is used in this young female for the purposes of both chin augmentation and correction of the labiomental unevenness. (a) A technique similar to 3D structuring is used here with 1 ml of Ellanse S premixed with 0.3 ml of lidocaine by cannula. (b) The photograph one month after treatment demonstrates a straightened lower cheek curve connecting to the chin that projects more.

6.17 EARLOBE

Earlobe augmentation is an easy and quick procedure using injectable fillers. Earlobe esthetics are sometimes related to beliefs about facial fortune-telling.

6.17.1 Frequently Encountered Problems

Augmentation enlargement is usually the main request for earlobe treatment. Bigger ears are believed to be related to good fortune or long lives. Surgery or trauma resulting in asymmetric sizes of the earlobe or congenital micro-lobes could also be addressed with moderate enlargement using fillers.

6.17.2 Selection of Fillers

Earlobes are soft hanging semidetached structures. Fillers to be filled should maintain the soft character. HA fillers fit better.

6.17.3 Injecting Techniques

A single- or multifocal bolus injection of HA with molding suffices for the purpose (**Figure 6.71**).

6.17.4 Cautions

Overuse of filler in the earlobe interferes with blood circulation and could result in a telangiectatic appearance. The artery of concern here is the Zilinsky-Cotofana arcade that connects the anterior inferior to the anterior superior auricular artery. These arteries anastomose at the helical rim and form the earlobe arterial vascular network. Due to its vascularization, there are no major concerns about intra-arterial product application.

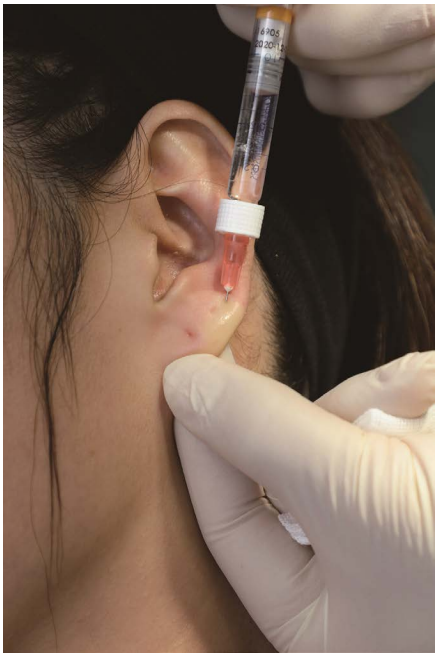

FIGURE 6.71 Simple needle injections could suffice the goal for filling the earlobe. Restylane Skinbooster is used in this young female for earlobe augmentation.

6.17.5 Clinical Effect and Limitations

The extent of correctable magnification is related to the extensibility of the earlobe tissue (**Figure 6.72b**). Overdosing in a tight earlobe could inflate a rather biconcave plate-like structure into a ball.

6.18 CHIN

The chin is the only area with injectable fillers where we can change the longitudinal facial dimension and proportions. The direction of projection on the chin is related to how the facial profile is preferred. The balance of the chin with the maxillary alveolar process could be interpreted as orthodontic correctness. The chin together with the jawline provides bony support for cheek soft tissue, alleviating the sagging problem of the cheeks. Sexual dimorphism also plays a role with the chin that is an important determinant of attractiveness. In males, a wide and square chin is considered to be masculine, whereas in females a narrow and pointy chin is considered more feminine. The underlying anatomy, however, is similar as the chin is mainly determined by the deep mental fat pat overlying the bone and covered by the radiating muscle fibers of the mentalis muscle.

6.18.1 Overview of the Anatomy of the Perioral Region

The perioral region is bordered by the nasolabial sulci and the nose cranially, the modiolus and the labiomandibular sulci laterally, and the submental septum caudally. No real distinct layered arrangement can be identified in this region; the layers can best be described as skin (layer 1), subcutaneous fat (layer 2), musculature (i.e., orbicularis oris muscle, mentalis muscle) (layer 3) (**Figures 6.73** and **6.74**), deep fat

FIGURE 6.72 (a) The original small earlobe is moderately enlarged and thickened with very natural texture. (b) This injection does not interfere with earring holes and the new shape pairs better with the earrings.

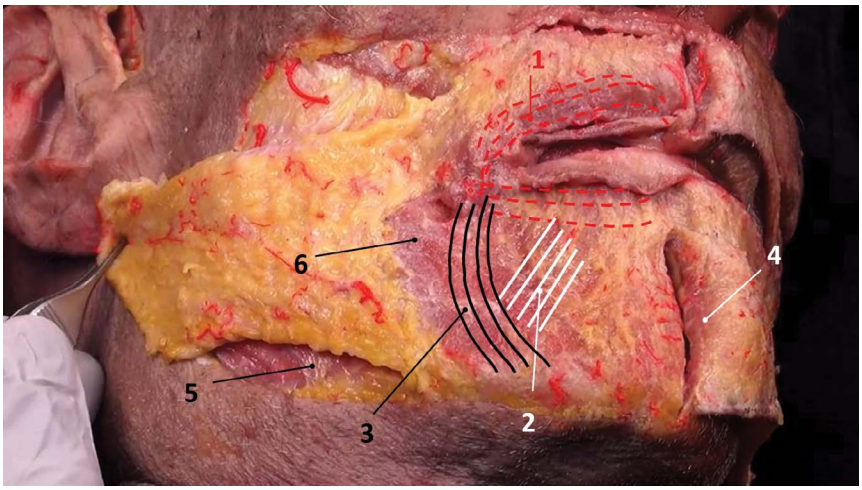

FIGURE 6.73 Cadaveric dissection of the lower face after the removal of the skin and subcutaneous fat. The perioral musculature is depicted, including the orbicularis oris muscle (1), depressor labii inferioris muscle (2), depressor anguli oris muscle (3), mentalis muscle (4), platysma (5), and risorius muscle (6).

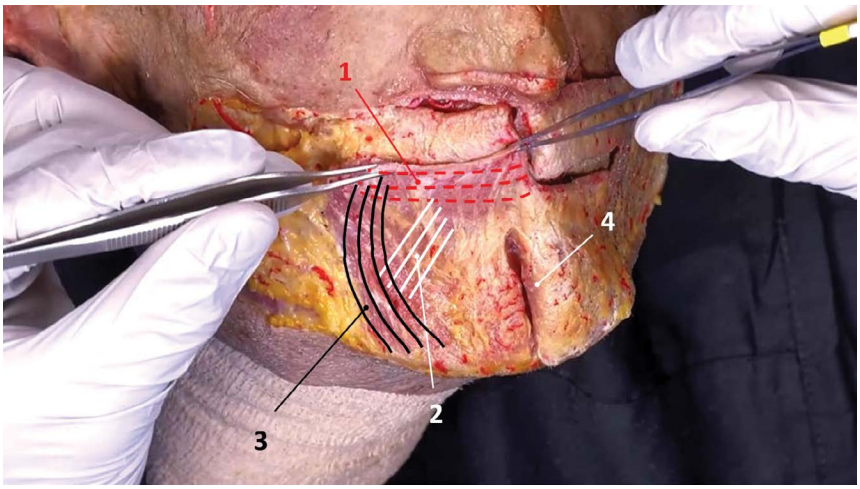

FIGURE 6.74 Cadaveric dissection of the lower face after the removal of the skin and subcutaneous fat. The perioral musculature is depicted, including the orbicularis oris muscle (1), depressor labii inferioris muscle (2), depressor anguli oris muscle (3), and mentalis muscle (4).

(deep chin fat in the midline, labiomandibular fat protecting the neurovasculature around the mental foramen), and periosteum (layer 5). Similar to the nasolabial sulcus, the labiomandibular sulcus is formed by a change in the subcutaneous architecture of the subcutaneous fat medial and lateral to it. The submental sulcus is the depression inferior to the chin between both mandibular ligaments. It is formed by the submental septum, an osteo-cutaneous adhesion emerging from the posterior aspect of the mandibular symphysis and inserted into the skin.

6.18.2 Frequently Encountered Problems

Longitudinal dimension, projection, orientation, shape and curve, fullness, smoothness of the mental skin, deviation, and asymmetry are the most complained about problems with the chin (**Figure 6.75**).

FIGURE 6.75 Filler injection could correct most morphological chin problems. Radiesse is used in this young female for increasing the chin dimension and change the direction of projection. Needle technique in a bolus or by tower technique gives more projection.

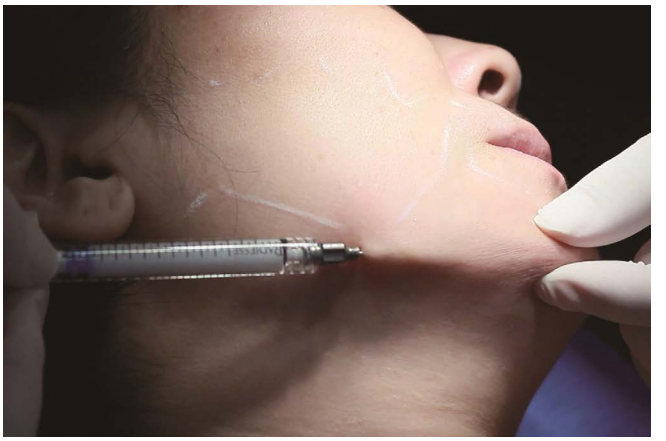

FIGURE 6.76 Chin augmentation can be done with a cannula technique that reaches the chin at the endpoint. Radiesse is used in this female case through a surgical cannula by the parallel linear threading technique. Radiesse is very high in elasticity, to assure satisfactory lifting capacity; premixing with minimal lidocaine can lower product viscosity for better malleability.

6.18.3 Selection of Fillers

Almost all fillers could play some role in improving part of the above problems. Fillers with stronger consistency are preferred to augment for dimension (**Figure 6.76**), to provide projection, and to reshape (**Figure 6.77**). PLLA can be injected differently to enhance these problems but will provide more gradual improvement and only soft definition. For the correction of surface evenness, softer gel HA fillers could be injected with easier molding redistribution to adapt it to local conditions (**Figure 6.78**).

6.18.4 Injecting Techniques

Bony depot is the injection technique to fortify bony structures. The tower technique penetrating multiple layers shows more targeted distribution and provides stronger support. PLLA can be injected as a depot,

FIGURE 6.77 Cadaveric dissection of the chin, demonstrating the bony origin of the mentalis muscle (1). The muscle then inserts superficially into the subcutaneous fat and dermis.

FIGURE 6.78 HA fillers are less stiff than Radiesse and should be modified in technique to give more prominent results. Juvederm Voluma is used in this Caucasian male for chin augmentation. The injection of HA filler in the chin has to be multilayered to be effective.

by fanning, or in a vertical linear pattern. Surface enhancement injection could adopt superficial depot techniques with good molding integration.

6.18.5 Cautions

PLLA when being injected into muscle – especially tendinous structures – will be restricted for redistribution and will possibly result in nodules. PLLA injection by bony depot on the chin could result in longer postinjection pain. Fibrosis of the injection area after biostimulation by agents like CaHA or PCL could increase resistance and difficulty for reinjection and create more risk by immobilizing the vascular structure. HA fillers even with higher lifting capacity should be controlled and injected modestly even if the disparity to be treated is large. HA fillers behave more or less like a gel. Softer gels should not be promised or used for adding dimension or definition. A lumpy appearance and bulging distortion often complicate the results. Hypertonic mentalis muscle should be modulated first to release space for further accommodation of injectable fillers (**Figure 6.79**).

FIGURE 6.79 The mentalis muscle is hypertonic in some patients and preferably should be treated first before filler injection. Contraction of this muscle interferes with filler distribution and limits the space to accommodate the augmented volume.

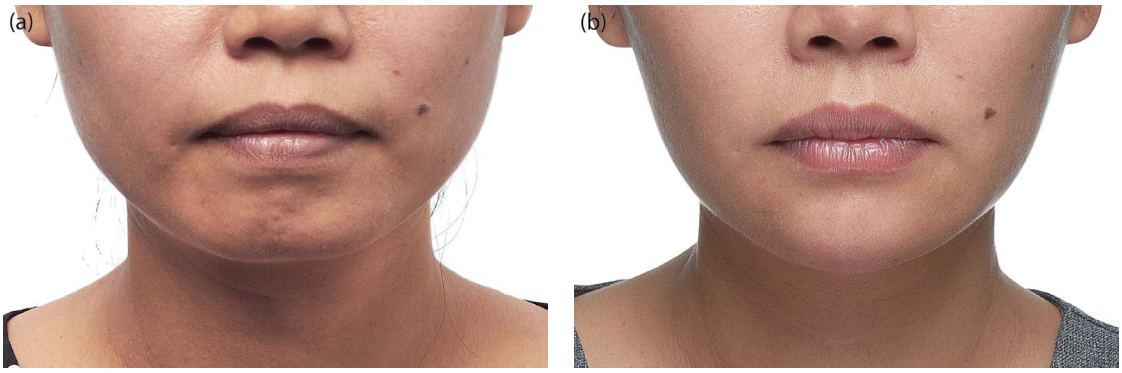

FIGURE 6.80 Restylane Lyft is used in this young female for augmentation in chin dimension and anterior-inferior projection. (a) Botulinum toxin is administrated at the same time to release the mentalis muscle. (b) The photograph 2 weeks after treatment shows satisfactory enhancement in the chin shape and dimension with natural connection to the jawline.

6.18.6 Clinical Effect and Limitations

Chin augmentation is one of the most satisfying injectable procedures. When augmenting the chin for improving the facial shape or prolonging facial dimensions (**Figure 6.80**), the proportion of the lower face above and below the oral commissure should be kept within a reasonable ratio. The problem of malocclusion through bone discrepancy could to some extent be treated by filler injection, including the chin; chin augmentation could improve a certain degree of tissue laxity by stretching loose soft tissue (**Figure 6.81**). Chin deviation could also be corrected by fillers but should be kept coherent with the axis of the nose and central lip. The ascending metal artery is found in most cases superficially; rarely, a deep branch of the submental artery is found in the supraperiosteal plane. Preinjection aspiration and slow injection can guide the injector toward safer outcomes.

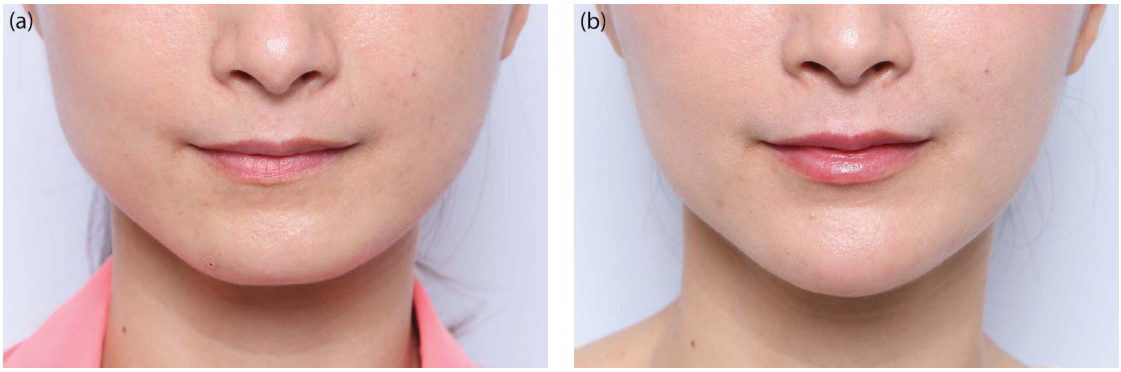

FIGURE 6.81 (a) Diluted Radiesse is used in this mature female for the chin and jawline augmentation along with the structuring of lower cheek. Toxin is also administrated at the same time on the masseter to improve the facial shape. (b) The photograph 2 weeks after treatment demonstrates good results with a chin flesh appearance better compatible with cheek fullness and a natural connection along the jawline to the mandibular angle. The shape of the face has become oval.

6.19 JAWLINE

The jawline is an important skin surface landmark marking the lower face and is formed by the mandible. The mandibular angle and the mandibular symphysis contribute to its formation. The contour of the jawline reveals sexual traits and signs of aging. Mandibular angle and jawline should be considered a unit when planning filler treatment for the lower face.

6.19.1 Overview of the Anatomy

The jawline has a classic five-layered arrangement consisting of skin (layer 1), subcutaneous fat (jowl fat compartment, layer 2), platysma (layer 3), deep fat (layer 4), and periosteum (layer 5). The facial artery and vein cross the mandible below the platysma (layer 3) (**Figure 6.82**) and are enveloped in the deep fat of layer 4. They travel posterior to the mandibular ligament. It is commonly believed that the anterior border of the masseter muscle marks the course of the vessels (**Figure 6.83**); however, these can also variably travel over the muscle itself. The marginal mandibular branch of the facial nerve overlies these vessels horizontally (**Figure 6.84**). The jowl fat is located posterior to the mandibular ligament anchoring the skin and the immediate adjacent subcutaneous tissue to the bone. Due to the multifactorial processes of aging, the jowl fat compartment descends, causing jowl deformity, as this is not fixed in position by the ligamentous adhesion. This is enforced by the high mobility of the platysma muscle, which has no bony adherence, in order to prevent compression of the facial artery and vein. Age-dependent inferior displacement of midfacial fat in turn depresses the mobile platysma, consequently also causing descent of the jowl fat compartment.

6.19.2 Frequently Encountered Problems

A blurred jawline is a common problem for patients who have sagging cheek, obesity, and underdevelopment of the mandibular bone (**Figure 6.85**). Mandibular underdevelopment could result in a smaller lower

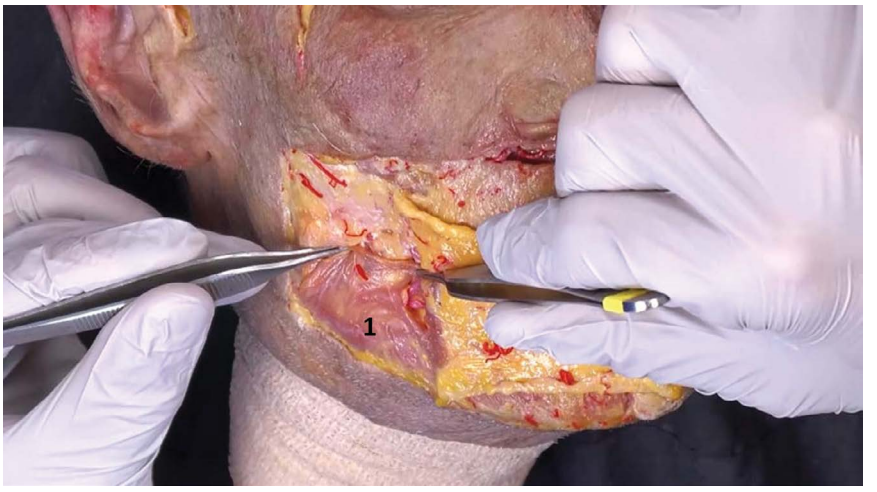

FIGURE 6.82 Cadaveric dissection of the lower face with its classic five-layered arrangement. The platysma (1) is found in layer 3, beneath the subcutaneous fat. Since the facial artery and vein are located deep to the platysma, the superficial subdermal and subcutaneous plane can be considered safe for injections.

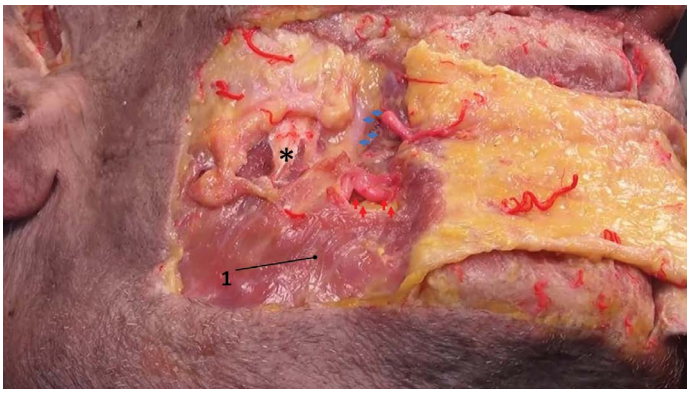

FIGURE 6.83 Cadaveric dissection of the lower face with its classic five-layered arrangement. The platysma (1) is found in layer 3, beneath the subcutaneous fat. Since the facial artery and vein are located deep to the platysma, the superficial subdermal and subcutaneous plane can be considered safe for injections. The facial artery and vein emerge roughly at the anterior border of the masseter muscle.

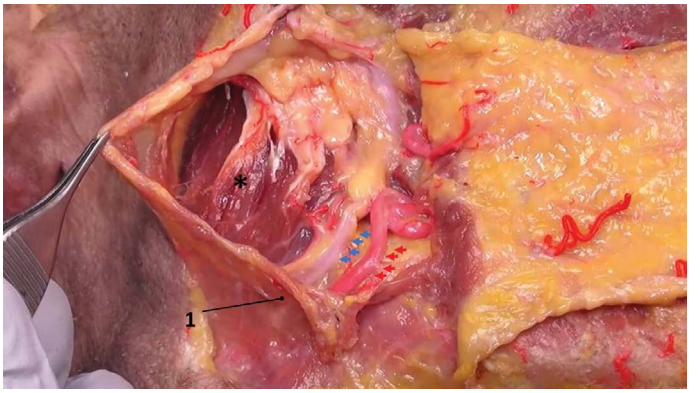

FIGURE 6.84 Cadaveric dissection of the lower face. The facial vein (blue arrows) and facial artery (red arrows) are exposed, crossing the mandible beneath the platysma (1) at the anterior boarder of the masseter muscle (*).

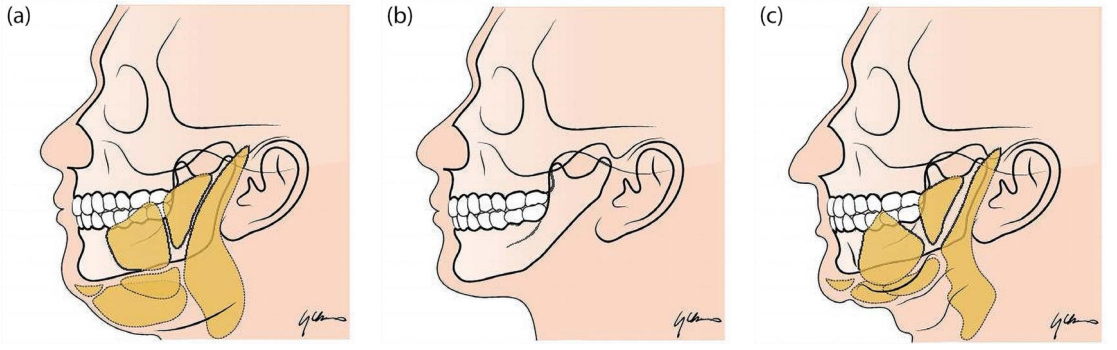

FIGURE 6.85 Poorly defined jawline could be attributed to underdevelopment of the mandibular bone (b) that should stand out posing as a bony ridge. Sagging of the soft tissue around the jaw (c) could blur the jawline as well though the mandibular ligament limits the descent of jaw fat pad. Age-related change of the jawline often present like a wavy ill-defined border. Obesity inflates the most of the fat compartments and then the confluent inflation hides the bony ridge (a).

face and a consequent childish appearance. A smaller bony frame restricts the soft tissue in a narrower space, imbuing chubbiness in youth and baggy cheeks when the tissue becomes loose. Some Western cultures are fascinated with a strong jawline and angular mandibular shape, even for females as a fashion. However, angles and a wide mandible are not embraced by Asians.

6.19.3 Selection of Fillers

Fillers to be used here should be the ones with high G′ and more fixed in shape to give definition and angles. PLLA can be used for strengthening the mandibular bony shape but more in a focal pattern and a low-key positioning. Biostimulation-induced stable fixed volume could be placed under and behind the mandible, stretching the cheek down and back to achieve a tightened appearance.

6.19.4 Injecting Techniques

PLLA can be injected along the margin of the mandible by the techniques of point depot and linear threading (**Figure 6.86**). CaHA and PCL can be delivered as a focal depot or in a tower pattern to give better support or in a linear pattern overlying the defining margin to form shape and angles. Parallel threading could be placed more efficiently by a cannula and the depot injection by needles. The layer of choice is the subdermal plane as this plane is mainly free of crucial neurovascular structures. The facial artery and vein and the marginal mandibular branch of the facial nerve are located deep to the platysma. Whereas most injection techniques can be administered with a cannula, the angle of the mandible can be additionally treated with a perpendicular injection in contact with the bone. Here, the product is administered into the masseter muscle and can result in similar surface projection compared to a subdermal cannula injection.

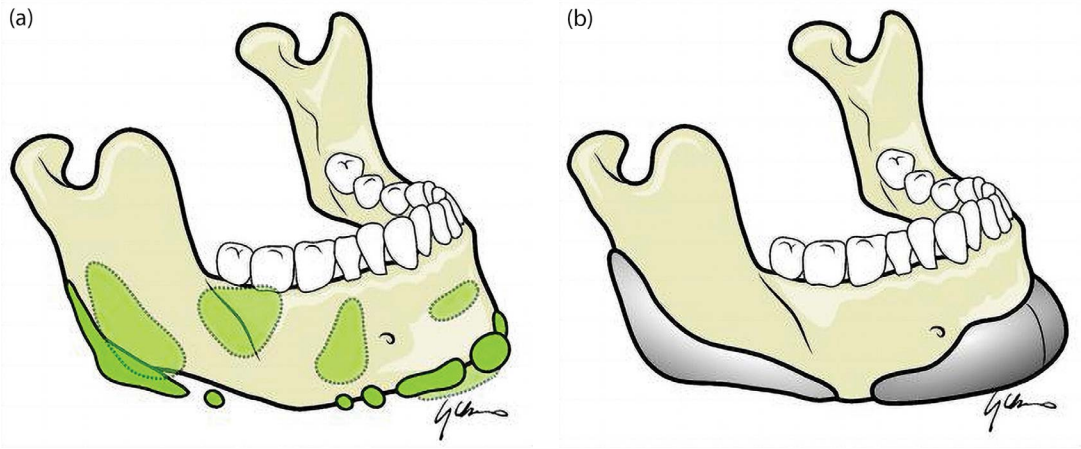

FIGURE 6.86 The benefit of injectable lower face augmentation is the possibility to insert filler both upon the bone and in the soft tissue, and in different depths flexibly according to individual conditions. (a) That makes the new chin and jawline continuous with the cheek as a unit. The limitation of filler injection is that it is soft in character. Implant of the chin and mandibular angle is limited in that it has to be fixed to the bone. This involves surgical dissection and is invasive. (b) Additionally, bony shape keeps on changing. An implant placed in youth could look strange upon bone resorption.

6.19.5 Cautions

The lower facial border is a critical one for injection in esthetic medicine. How the jawline is defined and the appropriateness of a mandibular angle should both be tailored according to a patient's demographic and culture background, profession, temperament, and personality. Communication before the treatment should be thorough for the injector to understand the patient better.

6.19.6 Clinical Effect and Limitations

The descent of a jowl fat pad creates an interruption of the jawline. Injection strengthening the jaw bone structure could pull it flat when being done correctly and improve the aging appearance. It could be useless to adopt softer fillers to give definition. Soft gels often mix with the shape of soft tissue. Repositioning the jowl fat should be targeted first and is comparable to the nasolabial sulcus deformity treatments. Since major vessels and nerves are located deep to the platysma, superficial subdermal and subcutaneous injections are recommended.

6.20 NECK

The neck is less approached with injectable fillers partly because it is more challenging in a technique and partly because of less volumetric issues relating to neck morphologic problems. From an anatomic perspective, esthetic treatments of the neck are less dangerous so long as they are performed subdermally and product administration is superficial to the platysma muscle. Deep to the platysma muscle, the cervical branch of the facial nerve and major arteries can be identified.

6.20.1 Overview of the Anatomy

When transferring the classical five-layered arrangement to the neck, the SMAS of the midface extends into the platysma in the lateral neck. It is enveloped by the superficial cervical fascia, similar to a sleeping bag. The distance between the skin and the superficial fascia increases with increasing BMI. Importantly, with increasing age, the distance between skin and superficial fascia decreases, irrespective of BMI. The superficial fascia (including the platysma in the neck), subdermal tissue, and the skin form a biomechanical unit due to connective fibrous tissue bands spanning between the fascia and the skin. Clinically, nonsurgical skin-tightening procedures should target the superficial fascia to provide a lifting and skin-tightening effect, as the changes in the fascia are translated to the skin via these connections. The platysma overlies a layer of deep fat. At the medial and lateral muscle boarder, the platysma transitions into connective tissue within the superficial cervical fascia, which shows strong adherence to the underlying investing layer of the deep cervical fascia. Major neural structures (i.e., structures of the cervical plexus) emerge deep, at the posterior margin in the middle third of the sternocleidomastoid muscle.

6.20.2 Frequently Encountered Problems

Horizontal necklines are the problem most inquired about that can be treated with injectable fillers. Biostimulating agents are nowadays delivered on the neck for improving aging skin of the neck.

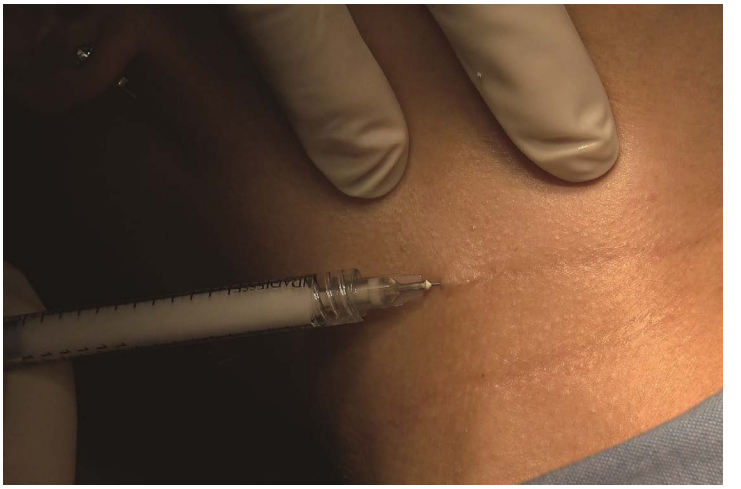

FIGURE 6.87 1:1 Diluted Radiesse with lidocaine is used in this middle-aged Asian female for the horizontal necklines with a half-inch 27-gauge needle.

6.20.3 Selection of Fillers

Hyper-diluted CaHA (**Figure 6.87**) has been used on the necklines with good results but is very challenging in technique. Cohesive soft HA fillers used as the blanching technique (**Figure 6.88**) can be used for the necklines as well. Biostimulating agents when being injected for the neck skin should be layered as evenly as possible (**Figure 6.89**).

6.20.4 Injecting Techniques

Cohesive HA can be injected following the blanching principle and placed very superficially along the necklines (**Figure 6.90**). CaHA should be largely diluted with lidocaine and injected in a very similar way

FIGURE 6.88 Belotero Balance is used in this middle-aged Asian female to seal necklines by blanching technique.

FIGURE 6.89 PLLA is used in this elderly Asian female for the improvement of neck skin texture via the needle technique.

but a little deeper than the blanching HA, ensuring that no product placement occurs deep to the platysma. The molding of both techniques after injection is extremely important. PLLA can be injected in multiple linear arrays in a shallow depth above the deep fascia to give thorough stimulatory function; hyper-diluted CaHA has been used similarly by needle, cannula, or being facilitated with hydrodissection.

6.20.5 Cautions

CaHA indicated for the necklines or neck skin should be diluted with saline or lidocaine. The author's experience favors 1:1 dilution for Asian skin (**Figure 6.91**) and 1:1–1:2 for thinner or Caucasian skin (**Figure 6.92**). Intricate penetration of the needle in about the same depth of 1–1.5 mm should be emphasized to keep the filling thread within a safe depth and effective. Shallow or abrupt outflow of the diluted CaHA can produce white papules. HA correction is softer than diluted CaHA and shows less effect when being injected deep or when the necklines are deep. HA filler injection with products of larger particles or less cohesivity could give a beading appearance. PLLA improves the quality of the skin with a

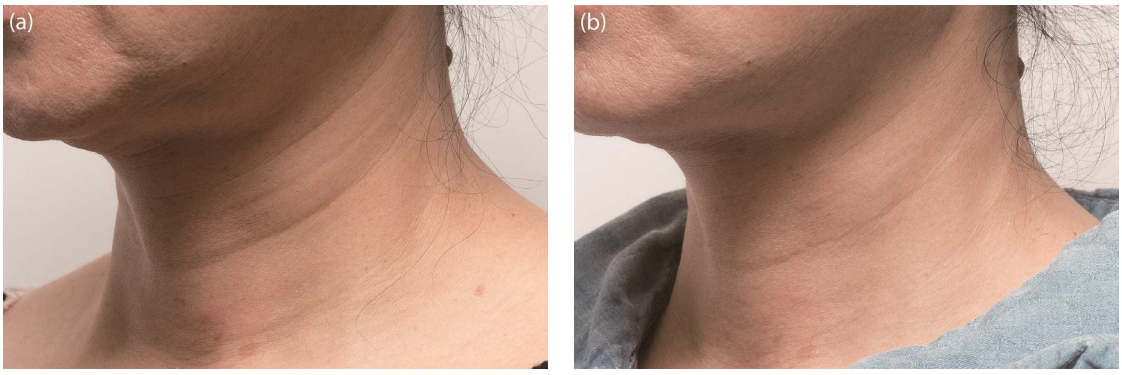

FIGURE 6.90 (a) This elderly female is the same one as in Figure 6.66. (b) The effects of Belotero Balance are natural in appearance but less effective than those of Radiesse, especially those in the sagging part of the neck.

FIGURE 6.91 (a) Horizontal necklines of this young Asian female are treated with the diluted Radiesse (1:1) needle technique. (b) Treated skin immediately after procedure often presents with prominent swelling and ecchymosis. (c) Most of the lines disappeared 2 weeks after treatment. The improvement is more prominent and predictable than that by HA fillers.

concomitant gain in volume; it is not suggested for patients with an obese neck. A cannula or needle used on the neck should be carefully controlled for depth of insertion because there are underlying big vessels and vital organs nearby. Cannula dissection often encounters resistance, while the counteracting force for advancing the instrument often offsets the protective purpose of its bluntness.

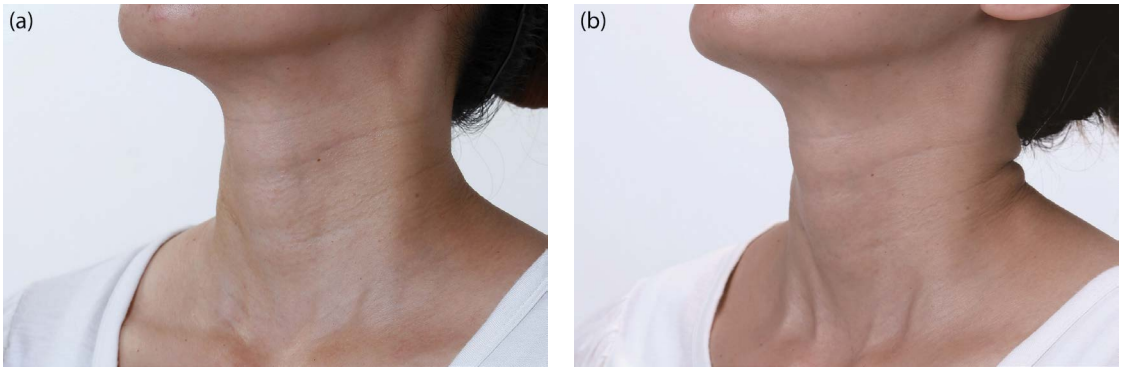

FIGURE 6.92 (a) Diluted Radiesse (1:1) is used for both the neck skin and necklines of this middle-aged Caucasian female via needle technique. (b) Neck skin improvement is prominent 2 weeks after treatment in the treated area (superior and posterior side). Necklines are improved well, without nodule formation.

6.20.6 Clinical Effect and Limitations

In obese necks where there is fat accumulation and adipose bands or in aging necks with descending lax tissue, fillers could improve matters only to a very limited extent.

6.21 DÉCOLLETAGE

The décolletage is the area constantly exposing to sunlight, showing signs of aging more rapidly. The tendency to wrinkles is more of a concern in patients with a lighter complexion, the habit of sun tanning, and more burden of tilt volume and weight. No major neurovascular structures can be appreciated in the subdermal plane.

6.21.1 Frequently Encountered Problems

Fine and deep wrinkles with poor skin quality are often the morphological problems indicated for injectable correction.

6.21.2 Selection of Fillers

Fine wrinkles could be rapidly improved by superficial HA injection, similar to fine wrinkles in other regions. Skin quality improvement should be treated with biostimulators like hyper-diluted CaHA or PLLA.

6.21.3 Injecting Techniques

HA for fine wrinkles using the blanching technique can be delivered in a similar way to visible fine lines. Skin quality improvement employing PLLA should preferably be by injection with needles for even distribution and better flexibility. Hyperdiluted CaHA can be deployed by serial linear layering with some enhancement crossing to make sure fillers are placed superficially and evenly enough (**Figure 6.93**).

6.21.4 Cautions

The cannula has been claimed to deliver filler safely; however, cannula injection often achieves its clinical results partially by tissue dissection – or, in other words, by tissue trauma. Cannula dissection is worrisome in the chest for patients with scarring tendencies.

6.21.5 Clinical Effect and Limitations

Aging is a whole thickness process, while stimulation injection approaches the skin only in a certain layer. Aging symptoms should be treated with combined modalities of light or energy to achieve more comprehensive effects.

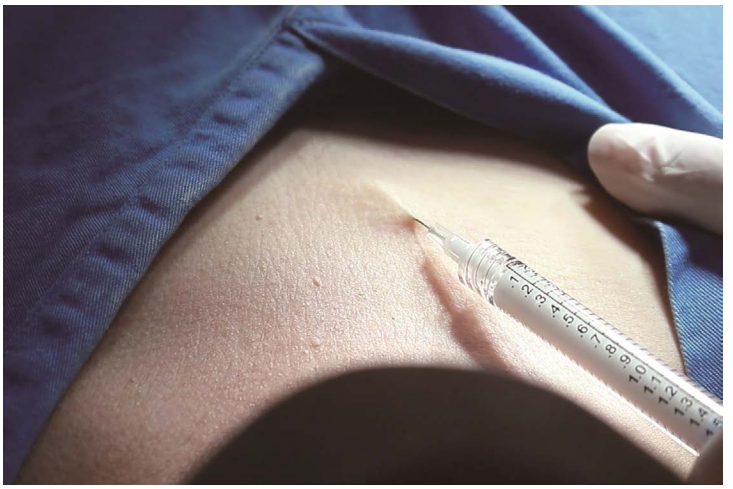

FIGURE 6.93 Diluted Radiesse (1:1) can be administrated in a similar way as that done for the neck in the décolletage. Serial linear threads actually distribute the filler more evenly than do multiple fans.

6.22 ARMS

Arms have been less approached with fillers until the advent of the recent biostimulation injection treatments. Treatments like this have achieved some satisfactory results. No major neurovascular structures can be appreciated in the subdermal plane.

6.22.1 Overview of the Anatomy

The layered anatomy of the arms and thighs is comparable: five different layers can be identified independent of age, sex, or BMI: skin (layer 1), superficial fat (layer 2), superficial fascia (layer 3), deep fat (layer 4), and deep fascia (layer 5). Nonsurgical skin-tightening is most effective when targeting the superficial fascia; several small fibrous connective tissue bands span from this layer to the skin, thus enabling force transmission to the underside of the dermis.

6.22.2 Frequently Encountered Problems

Skin laxity presents as crêpiness. Skin and the soft tissue envelope sag with gravity and present as flappy arms. The anatomical background for this is the relaxation of the superficial fascial system. This system includes retinacula cutis, the superficial fascia, and the deep fascia in a biomechanical unit. The space between the retinacula and superficial and deep to the superficial fascia is filled with fat. An age-related reduction in overall fat mass and soft tissue laxity result in the weakening of this system, which ultimately affects the skin surface; there, the effects of the age-related changes of the subdermal architecture are most visible.

6.22.3 Selection of Fillers

Biostimulating fillers could strengthen the structure to achieve some firming effects.

6.22.4 Injecting Techniques

As with the injection improving skin quality in other areas, a cannula and needles can be used for placing PLLA, hyper-diluted CaHA, etc., under the skin and into the superficial fatty layer.

6.22.5 Cautions

Hyperdiluted CaHA or PLLA injected too superficially could be visible as white tracts or result in an irregular surface; however, when injected too deep they would give only limited clinical effects. The skin of the inner arm is extremely thin. The injection should proceed from the part showing most laxity to the margin and be well adjusted in depth according to local skin thickness.

6.22.6 Clinical Effect and Limitations

The tightening effect comes more from the skin and superficial subcutaneous tissue. Patients with tissue redundancy could benefit from these injections to only a very limited extent.

6.23 HANDS AND FEET

Prominent veins and tendons of the dorsum of the hand and feet along with skin laxity can be improved by injectable fillers. A full and smooth hand or foot contour is regarded as youthful and a sign of health and well-being.

6.23.1 Overview of the Anatomy

The layered arrangement of the hand can be described as follows: skin, the dorsal superficial lamina, the dorsal superficial fascia, the dorsal intermediate lamina, the dorsal intermediate fascia, the dorsal deep lamina, and the dorsal deep fascia. The dorsal superficial lamina contains no veins or major sensory nerves. Longitudinally (proximal-to-distal), it is invested by septa spanning between the dorsal superficial fascia and the skin, providing a natural border for soft tissue material injected into this layer. The dorsal veins and sensory nerve branches of the hand are embedded within the intermediate lamina, below the dorsal superficial fascia. The extensor tendons travel within fibrous canals formed by the dorsal intermediate fascia and the dorsal deep fascia. At the distal third of the dorsum, distal to a line 1.5 cm proximal to the metacarpophalangeal joints, the clear layered arrangement is lost. With regard to the foot, the following anatomical layers can be identified: skin, dorsal superficial fatty layer, dorsal superficial fascia, dorsal intermediate fatty layer, and dorsal deep fascia (with a superficial lamina and deep lamina). Similar to the hand, subdermally, within the dorsal superficial fatty layer, no major neurovascular structures are found. Below the dorsal superficial fascia, the dorsal venous arch and branches of the superficial fibular and sural nerve course through the dorsal intermediate fatty layer. The extensor tendons are enclosed within the two laminae of the dorsal deep fascia. The dorsalis pedis artery and the terminal branch of the deep fibular nerve course through a fascial tunnel of the dorsal deep fascia in the first intermetatarsal space.

6.23.2 Frequently Encountered Problems

There is often surface roughness due to visible underlying structures and poor skin quality.

6.23.3 Selection of Fillers

PLLA, CaHA, and HA all have been reported for dorsal hand augmentation.

6.23.4 Injecting Techniques

Bolus injection with postinjection molding for redistribution and cannula placement in the valleys between phalanges are the two basic injection techniques for diluted CaHA or PLLA. Multiple injection techniques have been described, but the proximal-to-distal cannula injection technique has been proven to be the most effective. This technique distributes the material evenly into the dorsal superficial lamina (subdermal fatty layer), which has been shown to free of major neurovascular structures. HA fillers are usually injected as multiple micropunctures from the surface to improve skin quality (**Figure 6.94**). A study investigating adverse events in hand volumizing procedures found least complications when using a cannula and the proximal-to-distal fanning technique placed subdermally within the dorsal superficial lamina. Similarly, for the dorsal foot, injections with a blunt-tip cannula (i.e., 22 G), using the proximal-to-distal fanning technique within the dorsal superficial fatty layer, are recommended.

6.23.5 Cautions

When patients have obvious tendons or veins on the dorsal hand, their fingers also usually present a rough appearance with prominent joints and suboptimal fullness. Finger injection is more difficult in the techniques required and can hardly be completely satisfactory. Injury to the digital nerves and tendons could also occur via these injections. PLLA nodules occur more on the dorsal hands and occur more by bolus injection.

6.23.6 Clinical Effect and Limitations

The match between face and hands is raising more and more awareness. Expenditure on jewelry and watches should be matched by concern for the body units adorned with them! Skin quality improvement should be achieved in combination with light-based treatments and topical agents.

FIGURE 6.94 Dorsal hand injection with a cannula can reach most dorsal hand corners via a single-entry hole by gliding above the fascia. Hydrodissection could assist preparation of the dorsal hand space.

6.24 ABDOMEN

The abdomen is not commonly treated with injectable fillers but is increasingly the object of the emerging biostimulatory agents. No major neurovascular structures can be appreciated in the subdermal plane.

6.24.1 Overview of the Anatomy

The layered anatomy of the abdomen includes skin (layer 1), superficial fat (layer 2), Scarpa's fascia (layer 3), deep fat (layer 4), and deep fascia (layer 5) above the muscles of the anterior abdominal wall. Total abdominal wall fat thickness increases with increasing BMI, mainly due to an increase of fat below Scarpa's fascia. Aging causes a decrease of the superficial fatty layer, while at the same time contributing to an increase of the deep fatty layer.

6.24.2 Frequently Encountered Problems

Laxity of tissue and striae distensae are the main reasons for which patients request treatment. Iatrogenic or trauma-related abdominal wall defects could be improved with fillers through volume restoration.

6.24.3 Selection of Fillers

Diluted CaHA and PLLA are usually indicated for striae and tissue laxity, but defect filling could be considered with other linear fillers as well.

6.24.4 Injecting Techniques

The parallel linear technique using needles is controllable for equal depth and even distribution and is less traumatic. The density of these threads and their planned pattern of distribution could be adjusted to emphasize regions in poor condition (**Figure 6.95**).

FIGURE 6.95 Diluted Radiesse is also used for striae distensae and has to be applied superficially enough and preferably perpendicularly to the striae.

6.24.5 Cautions

Striae correction is more concerned with augmenting breaks of skin and strengthening the tissue rather than removing scars. For patients with obesity and striae clefts extending deeply, the clinical effect of injections is usually limited.

6.24.6 Clinical Effect and Limitations

Skin appears better in quality and smoothness and more flattened in the rippled striae area.

6.25 BUTTOCKS

The shape of the buttocks is emphasized in some areas of the world. Filler injection is one of the easiest and fast ways to improve gluteal esthetics. No major neurovascular structures can be appreciated in the subdermal plane.

6.25.1 Overview of the Anatomy

The layered arrangement of the gluteal region contains skin (layer 1), superficial fat (layer 2), superficial fascia (layer 3), deep fat (layer 4), and deep fascia (layer 5) covering the gluteal musculature. The subcutaneous architecture shows differences between men and women, thereby providing an explanation for the development of cellulite frequently observed in females. Irrespective of gender, the superficial and deep fats form a honeycomb-like structure, with numerous short and thin septa linking the superficial fascia with the skin, and thick strong septa containing neurovascular bundles connecting the deep fascia to the dermis. Females have significantly fewer fat lobules and connecting septa within the superficial fat compared to men, and each lobule has increased height and width. The structural characteristics of the fat and the biomechanical forces exerted at the subdermal junction determine the existence of cellulite. The skin surface is at balance between extrusion and containing forces, determined by the skin, the septal network (inward pulling force), and the fat lobules (outward force). The increased height of fat lobules, together with the limited amount of fibrous septa, causes less stability at the skin surface in females, increasing the probability of a mattress-like appearance at the skin surface.

6.25.2 Frequently Encountered Problems

Volume insufficiency, suboptimal buttock contour because of fat atrophy, trauma, inflammation, injection, and fat distribution, irregular surface, cellulite, skin laxity, and striae are the usual presenting problems that could be improved by filler injection.

6.25.3 Selection of Fillers

Both linear fillers and PLLA could provide volume. PLLA is cost-effective, providing volume and improving tissue quality at the same time. Diluted CaHA has also been shown to improve skin quality, striae, and cellulite.

6.25.4 Injecting Techniques

A large bolus injection should be avoided even when the volume deficit is large to prevent pool-like filler accumulation or nodule formation. Separated aliquots in multiple layers and multifocal should be applied by adapting to local contours. Biostimulating injection could proceed as in other areas.

6.25.5 Cautions

Dimples and depressions are not always simple problems of volume. Over-focus on focal defects with large doses could result in nodule or cystic lesion formation.

6.25.6 Clinical Effect and Limitations

Cellulite formation involves fibrous bands. Complete treatment should combine other treatment modalities, including subcision of the bands deep to the dimple.

6.26 KNEES

The knee is also rarely indicated for filler injection, but knee appearance could be improved by filler injection through enhancement in volume and in tissue quality. No major neurovascular structures can be appreciated in the subdermal plane.

6.26.1 Frequently Encountered Problems

Irregular surface, depressions, and suboptimal contours of the knee area, wrinkles, and laxity of the knee skin can be addressed by filler injection.

6.26.2 Selection of Fillers

HA, PLLA, and diluted CaHA can all be used for skin quality improvement; HA and PLLA have been used here for volume restoration.

6.26.3 Injecting Techniques

Biostimulation injection in this area should be more superficial than the other areas, about the level of dermis or subdermal to achieve a visible effect. Needles are more often used for knee skin (**Figure 6.96**).

6.26.4 Cautions

Knee skin is rather tough and thick, even with signs of laxity and wrinkles. Crossing or closer arrangement could be modified according to focal deficiency.

FIGURE 6.96 Needle injection is also preferred for the thick knee skin with diluted Radiesse. Injection has to be superficial enough to achieve visible effects.

6.26.5 Clinical Effect and Limitations

A knee volume discrepancy or shape problem comes partly from bone or muscle structure. Injection of fillers should be planned for minor adjustments only.

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7 Adapting Injection Techniques to Special Indications

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Contents

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7.1 INTRODUCTION

Some of the clinical practice that uses injectable fillers for tissues across regions and layers for specific purposes should be planned and arranged differently from the standard way and be integrated for a more integrated result.

7.2 SCARS

Scars that can be improved by injectable fillers are those with volume loss or impairment in tissue quality.

7.2.1 Structure and Mechanism

Acne scars develop from inflammatory acne destruction that extends deeply. Volume loss and fibrotic change are coupled with the destruction of the original fibro-elastic framework; that is why patients with acne scars would face their signs of aging earlier – traumatic tissue destruction results in tear, break, loss of tissue, and fibrotic changes. Operation scars create problems with fibrotic tethering and sometimes loss of volume. Hypertrophic scars, texture, and scars in skin of color could be less amenable to improvement from filler injection.

7.2.2 Types

Depressive acne scars show the different extents of depth and tissue extensibility. The margin of scar pits and depressions could come with rolling borders or sharp cliffs (**Figure 7.1**). The fibrotic status of the scar also impacts the effect of filler augmentation. Traumatic and surgical scars that could be improved by fillers are largely concerned with volume replacement.

7.2.3 Selection of Fillers

Depressed scars are often corrected with hyaluronic acid (HA) fillers when an injection is the planned treatment (**Figure 7.2**). However, volume loss of scars and scarring fibrosis usually occur together. That could make filler correction of the volume deficits imprecise. HA fillers are gel-like substances. When

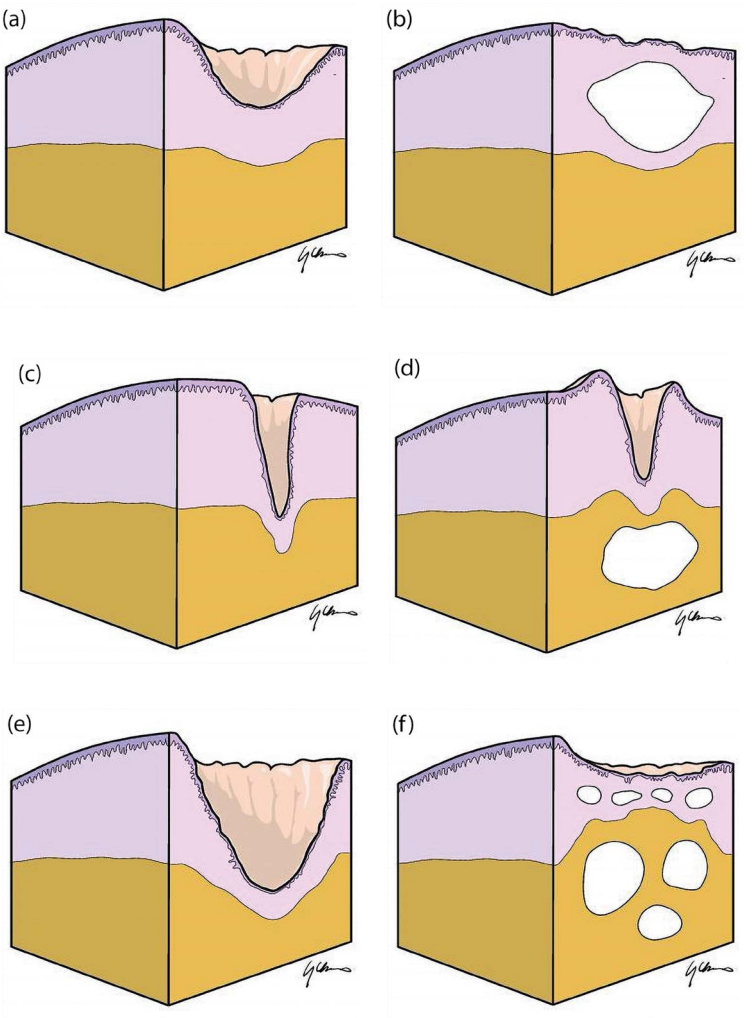

FIGURE 7.1 Filler augmentation strategy should vary according to the type of scar and tissue condition. (a and b) For shallow rolling scars and a scar with preserved dermal thickness, filler injection should be targeted to the dermis for better precision and lifting effect. (c) Icepick scars cannot be much improved by filler injection. (d) The augmented volume elevates the cliff border as well while the pits still remain. (e and f) In deep atrophic scars and scars with a thin dermis, injection of filler should be performed in multiple layers separately.

gels are inserted into dense fibrotic tissue, they tend to be expelled out. The filler filled below or next to the scar could further deepen the contrast and aggravate the situation. Filler filled above the fibrotic aggregate could camouflage the contour defect but the tissue above it has to be thick enough (**Figure 7.3a** and **b**). Poly-L-lactic acid (PLLA) is a rather stable choice for correcting the scarring depression. Needle injection works similarly to the treatment of subcision and creates some specific spaces to accommodate PLLA substance. The increased volume several months after injection is continuous with self-tissue and the scar will not raise the concern of dislocation or deformity if the initial placement of PLLA is precisely in the scar tissue (see Section 4.7). Some permanent fillers such as polymethyl-methacrylate (PMMA) have been approved by the Food and Drug Administration (FDA) for the correction of acne scars; however, permanent fillers bring permanent worries about contamination when further injections and wounding procedures are to be performed there.

FIGURE 7.2 HA fillers for depressive scars are preferably injected superficially and delivered from the margin or at a distance to prevent leaking of the inserted material.

7.2.4 Injecting Techniques

Injection should be directed to the scarring foci precisely in location and depth. The size of aliquots should be small, adapting to the extent of volume deficiency. The dose of filler should be divided into multiple small parcels when the volume deficit is prominent. The needle could aim more precisely and reach the skin more superficially. PLLA, when applied for acne scars, can be administered by whole layer strengthening, inverted depots, and targeted fanning or cross-hatching.

7.2.5 Cautions

Filler treatment for the scars should be weighted according to the extent and severity of scar fibrosis. Rigid banding of tissue could interfere with the distribution of fillers, especially when the inserted volume will be pulled and pressed by muscles.

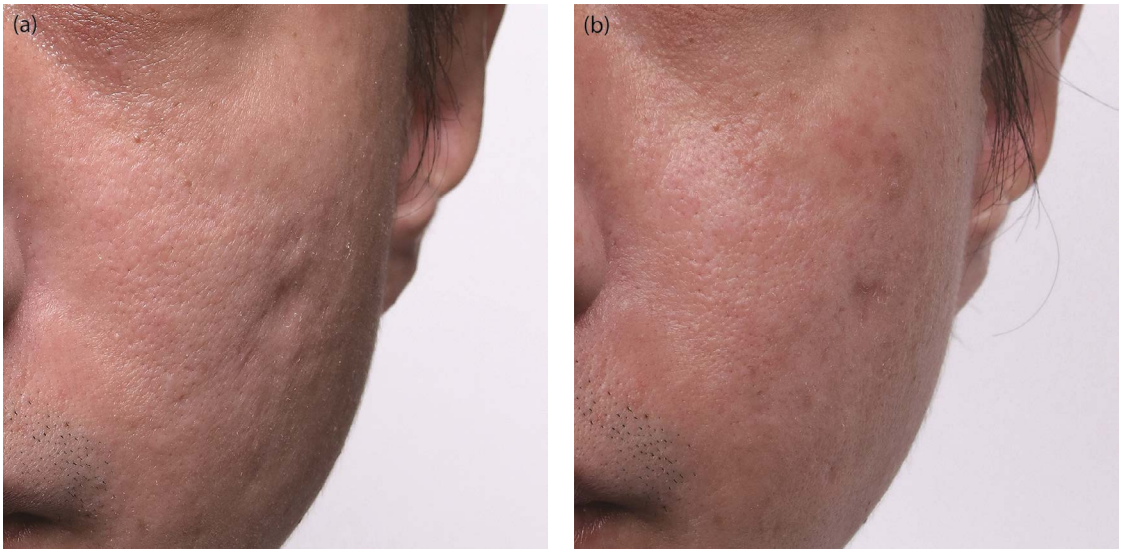

FIGURE 7.3 (a) Atrophic scars could usually be corrected immediately upon finishing the injection. (b) Scars that are most suitable for HA injection are those with shallow depth, minimal fibrosis, and distensible overlying skin.

7.2.6 Clinical Effect and Limitations

When injected filler occupies tissue and lifts the depressed surface, scar depression could be improved by injection. Any tethering of tissue should be corrected by subcision or surgical release, not filler injection.

7.3 ASYMMETRIC FACES

Morphologic disparity appears as volume imbalance and, of course, could be corrected to some extent by volume augmentation.

7.3.1 Structure and Mechanism

Facial asymmetry is a normal and physiologic condition present in every patient and normally not clinically apparent. In some patients, however, the asymmetry can reach a clinically meaningful grade and can result from developmental inequality, diseases, trauma, imbalanced use of muscles, and iatrogenic reasons. These asymmetries could be blamed on multiple layers of tissue from bone depth. Correction of the asymmetric face requires the highest level of injection art. Injectors should be aware of the excess and deficiency of volume from side to side in every portion of the face to undertake the injection asymmetrically.

7.3.2 Examples

7.3.2.1 Case 1 (Figure 7.4a–c)

This young male – presenting with a skinny face, prominent type III malocclusion, and asymmetric and underdeveloped maxilla and zygomatic arch – asked for minimal invasive treatments for his sunken appearance. Asymmetric problems on the forehead with an uneven surface and in the dimensions of the mandible and zygomatic arch were also noted. Frontal bossing protruded more in the left side and the frontal width showed less in the right side. That further led to a protruding superior left temple that contrasted with the volume deficiency of the lower left temple and the curved right temple with less volume discrepancy. The zygomatic arch is wider in the right side but less protrusive. That resulted in a more hollowed appearance of the right cheek and a deeper grove above the nasolabial fold. The right mandible is wider, too, and left a more sunken shadow on the lateral cheek. The wider dimension of the right cheek pulled a similar amount of cheek soft tissue and appeared thinner in the right side. The longer route of the right side mimetic muscle pulled the skin more and resulted in more cordial lines. The lip protruded because of the malocclusion problem but showed deviation and eversion to the left. The mental part of the mandible protruded but presented with a retrusive curve.

Three sections of PLLA were given to combat the multiple asymmetry with injections applied on the forehead, temples, brows, cheekbone and cheek compartments, maxilla, mandible, chin, jawline, and the subdermal skin. One year after (**Figure 7.4b**), the patient showed great improvement in symmetry in terms of dimensions, surface, curve, and profile correction. In **Figure 7.4c**, whitish zones indicate where the doses of PLLA were put for the major corrections.

7.3.2.2 Case 2 (Figure 7.5a–c)

This young female with double facial deviation asked for enhancement with injectables. The whole upper sector of the face from zygomatic arch above showed counterclockwise rotation with the left brow, eye,

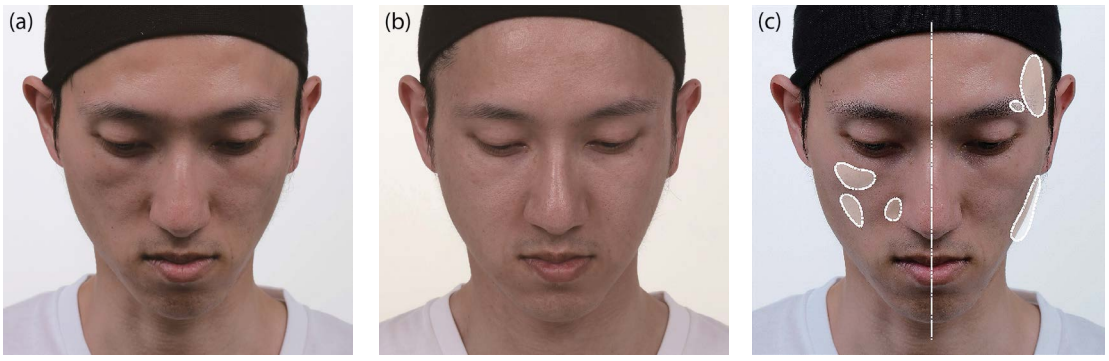

FIGURE 7.4 (a) Before treatment, (b) one year after treatments of only Sculptra injection, and (c) the treatment strategy.

and zygomatic arch all at a higher position. The shadow of glabella and the shine of the forehead showed clearly deviated curves. The nose was the only structure with a correct axis. The patient's lower face showed a right deviation. The right mandible is bigger and more angular; right cheek fullness is more and set lower; the lower lip and chin are deviated to the right, too, with the chin wider to the right and parachin soft tissue more deficient in the left side.

The correction was conducted with an HA filler gel (Restylane Defyne) on the forehead with the aim of respecting the deviated conformation of the face but making any deficiency or deviation less visible in the key areas. Cheek curve and volume are adjusted using Restylane Volyme to compensate for the larger space on the left side. Toxin is applied for the adjustment of mandibular angle. Restylane Lyft was used for creating projection with an adjusted direction. The whitish zone in **Figure 7.5c** indicates the major corrections.

Two months after treatment, the forehead appeared full with a less prominent axis and the cheek curves are more equal at both sides. The chin showed protruding roundness approximately on the right axis.

7.3.3 Selection of Fillers

Almost every kind of filler can be considered for asymmetry correction as asymmetry involves more than one layer of tissue. The choice of filler should match the deficient tissue type. A rigid substance can be chosen for creating rigid shapes and softer fillers for compensating soft tissue deficiency. PLLA is a

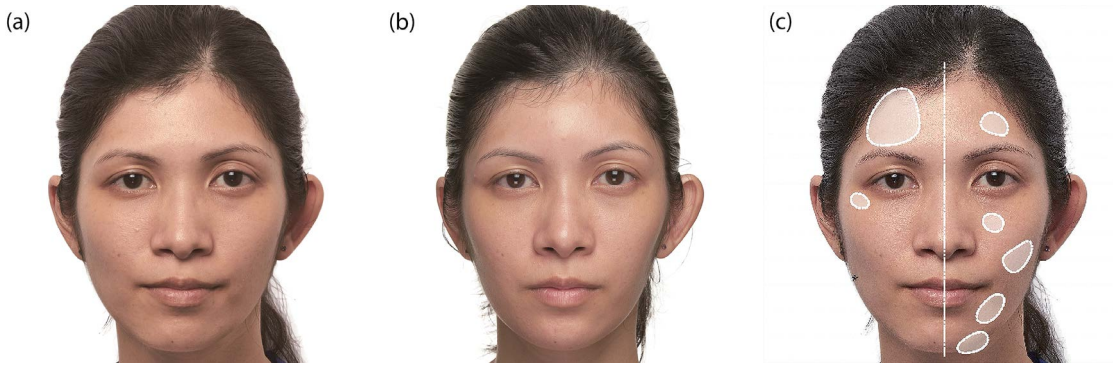

FIGURE 7.5 (a) Before treatment, (b) 2 months after treatment with HA fillers and toxin, and (c) the strategy behind treatment.

filler high in volume efficiency, capable of versatile functions in different layers, and can be considered a good choice for adjusting facial asymmetry.

7.3.4 Injecting Techniques

As different fillers would be chosen according to the types of tissue and the region of deficiency, injection techniques should be modified on a case-by-case basis.

7.3.5 Cautions

Injection of fillers for the correction of facial asymmetry should be viewed as both pathognomonic correction and morphological camouflages. The injected fillers intended to correct asymmetric objects must be asymmetric in distribution as well. The resemblance with tissue structure and the normal pattern of dynamicity should be kept in mind simultaneously.

Asymmetry and deviation treatments should not strictly follow the right axis as that could result in more discrepancy, especially if eyes have been deviated obviously (see **Figure 7.5**).

7.3.6 Clinical Effect and Limitations

The resting facial shape and contours can be adjusted by filler addition to the deficient side to aid with symmetry. The added volume could look more symmetrical than before in the resting state but can become a weird-looking lump after muscles contract. Unfortunately, it is almost impossible to achieve both dynamic symmetry and resting symmetry.

7.4 FACIAL PROPORTIONS

Ideal faces are always described as three equal transverse sectors and five vertical portions. If the patient has unequal partitions, fillers can only be employed for some of these suboptimal conditions.

7.4.1 Structure and Mechanism

Though the division of the facial sectors is based on outward facial landmarks, the dimensions of the face in each area are mainly determined by the underlying bony structure, especially in the longitudinal direction.

7.4.2 Types

Of the three sectors of the upper, middle, and lower face, elongation of the lower face is the only treatment that can be achieved by filler injection. The midface dimension has been set by the fixed structures of the brow and nasal spine but could be adjusted visually by the augmentation that alters the transition and contour projection. The upper face dimension is not correctable because it is determined by the fixed brow and hairline, but it could be adjusted visually by correcting the pattern of forehead profile. The five

transverse sectors of a face could be changed in the most lateral part by filler injection. However, these changes by filler insertion can only proceed by increasing one dimension.

7.4.3 Selection of Fillers

Augmentation for dimension should use fillers with better lifting capacity or conformational correction with injectable PLLA.

7.4.4 Injecting Techniques

Injection for the forehead could consider the cannula technique facilitated by hydrodissection (see Section 4.3). Injection for the chin or maxilla could be in the bolus or modified threading technique (see Section 3.4).

7.4.5 Cautions

Lower face augmentation prolongs the vertical facial dimension and increases the ratio of the lower one-third of the face. Injectors have to weigh up the relative proportions of the upper and lower lips since injection adds dimension to the lower lip only. Injectors should be more focused on individualized enhancement for their specific patient rather than become obsessive to meet some abstract magic ratios. The attempts to be closer to a certain ratio by augmentation may inversely ruin the look by inflating the face and changing its shape.

7.4.6 Clinical Effect and Limitations

Lower face elongation is not equal to chin augmentation because most of the lower face does not sit on the mandibular bone but only connects with soft tissues. Chin augmentation by fillers could extend wider to the lateral jawline and up to the buccal area covering the soft tissue and achieve a more natural look compared with the use of chin implants only (**Figure 7.6a** and **b**). The extent of correction is limited by the extensibility of the chin soft tissue envelop. When confronting the hypertonic mentalis muscle, filler augmentation should be performed after space is released by mentalis toxin treatment.

7.5 FACIAL SHAPES

According to different studies on Asian and Caucasian preferences, facial shape in an oval pattern is generally considered more attractive in both genders. Some studies found Asian females prefer faces in a heart shape that is close to the oval configuration.

7.5.1 Structure and Mechanism

The facial shape means the frontal appearance of the collective facial structures. The craniofacial bony framework is the fundamental structure deciding the main format, while the soft tissues have some impact on its smoothness, fullness, and transitions.

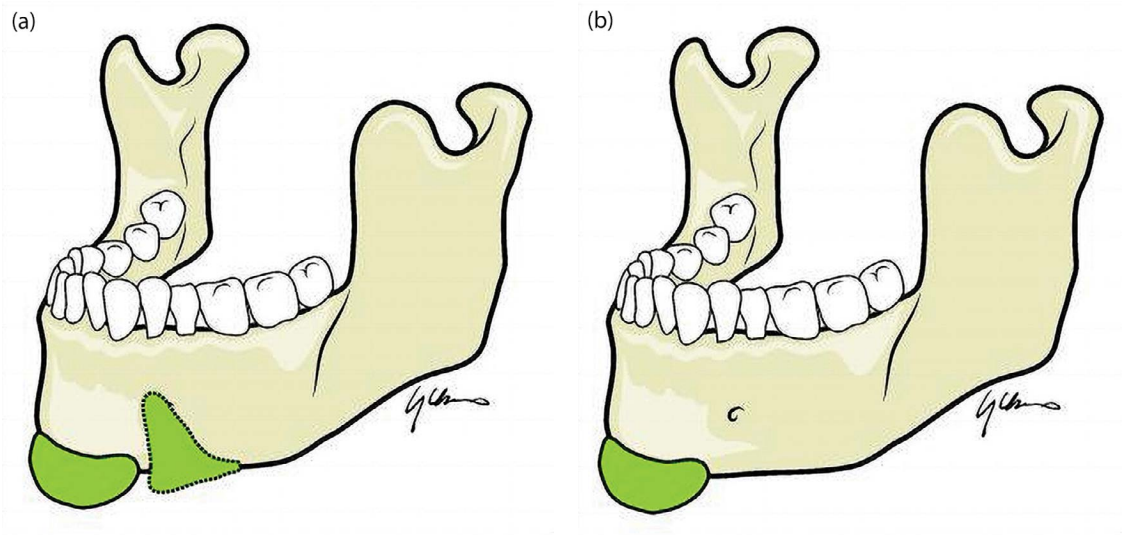

FIGURE 7.6 (a) An elegant curve and fullness connecting to the lateral cheek and the lateral jawline need to address the soft tissue around the chin. (b) Lower face injection or chin augmentation should not focus only on the tip of chin.

7.5.2 Types

Medical classification of facial shapes is different from other systems of classification emphasizing more the common features of facial structure and strategies for medical adjustment.

An oval face has components of a moderate longer format (and has been over-linked with the 'phi' ratio), a bigger upper sector, and smooth convex outward contours. Square and round faces have a shorter longitudinal dimension and similar height-to-width ratios; the square presents with more prominent mandibular angles and the round is angle-less. The heart shape could be understood as a modified oval shape with fuller cheeks (corresponding to the two lobes of the conventional icon of a heart) and a more tapered chin. The types of oblong or rectangular faces have longer height, while rectangular ones usually come with angular lower borders with the oblong blunter. Diamond or rhomboid shapes are the ones with prominent cheekbones but a lack of cheek fullness and temple volume.

7.5.3 Selection of Fillers

Strategies for the modification of facial shapes by injection consist of three key components. Fullness could be achieved by any fillers. HA fillers are generally more commonly used; PLLA could provide volume on a bigger scale. The dimension of the face could be prolonged as per the principles of adjusting facial proportion (see Section 7.5). (The third component – trimming – is not easy to achieve through filler injection; fortunately, as it is often indicated in the lower sector, it can to some extent be achieved with the help of botulinum toxin.)

7.5.4 Injecting Techniques

Different injecting techniques should be used according to the purposes of adding dimension or fullness (**Figure 7.7a** and **b**).

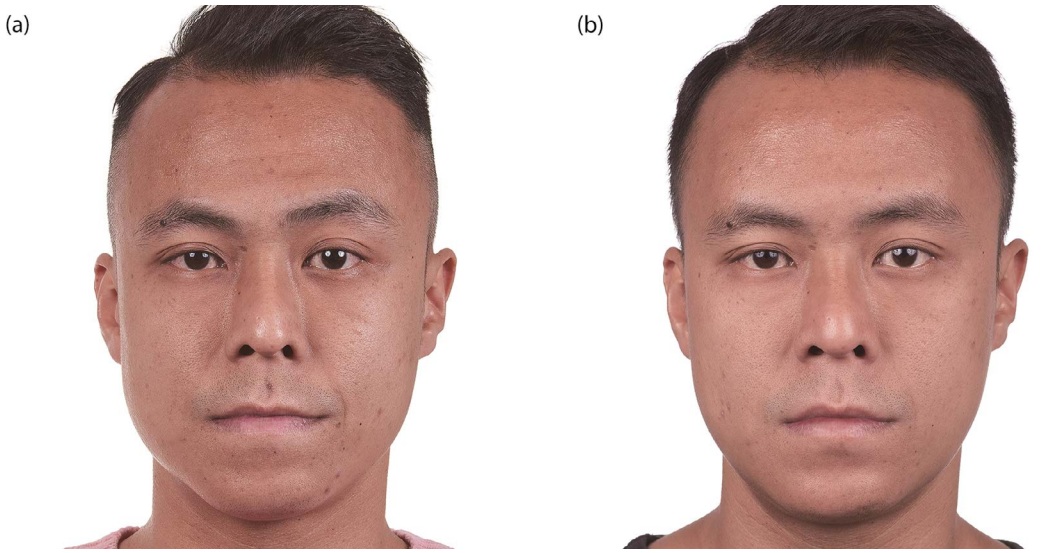

FIGURE 7.7 (a) The oblong bony framework pulls down the soft tissue and leaves a relative flat front. That happens mostly in the medial cheeks and the nose. The forehead of this young male is also flat. The other problems of this patient include a short and asymmetric brow ridge, a less defined cheekbone, tired appearing grooves, and asymmetric mandible, chin, and jawline. (b) His forehead is adjusted in width and curve by Restylane Defyne; cheekbones are defined with Restylane Defyne that additionally reverses the unequal ratio. The temples and cheeks are filled with Restylane Refyne to increase volume and erase wrinkles. The chin and jawline are adjusted with Restylane Lyft to increase projection and definition. Toxin is used to slim the lower face and correct symmetry. Two months after treatment, the patient shows better proportion and a more ideal shape.

7.5.5 Cautions

Facial shape describes the collective outer edges of a face in a front view. However, the lateral profile of a face closely relates to the front-view shape and has to be addressed accordingly. For example, in patients with a longer face, the longer cranial bones stretch cheek soft tissue and leave the cheeks flat with less chubbiness. Some round faces have an underdeveloped maxilla and mandible. The soft tissue of the shorter face and the soft tissue of the neck stack in limited spaces. That is why the jawline becomes obscured (**Figure 7.8a** and **b**).

7.5.6 Clinical Effect and Limitations

Injection could correct facial shapes when there is insufficiency. When the problem is dimensions are too long or too broad, filler could help by balancing via visual effects. Hair covers part of the face and has implications for the shape of the final layout. Hair conceals some pitfalls and can have synergic effects with injectable works.

7.6 LOWER FACE ALIGNMENT PROBLEMS

Malalignment of the maxillary and mandibular arches plays an important role in mid and lower facial contours. The malposition also results in malocclusion, which is sometimes treated with orthodontic procedures.

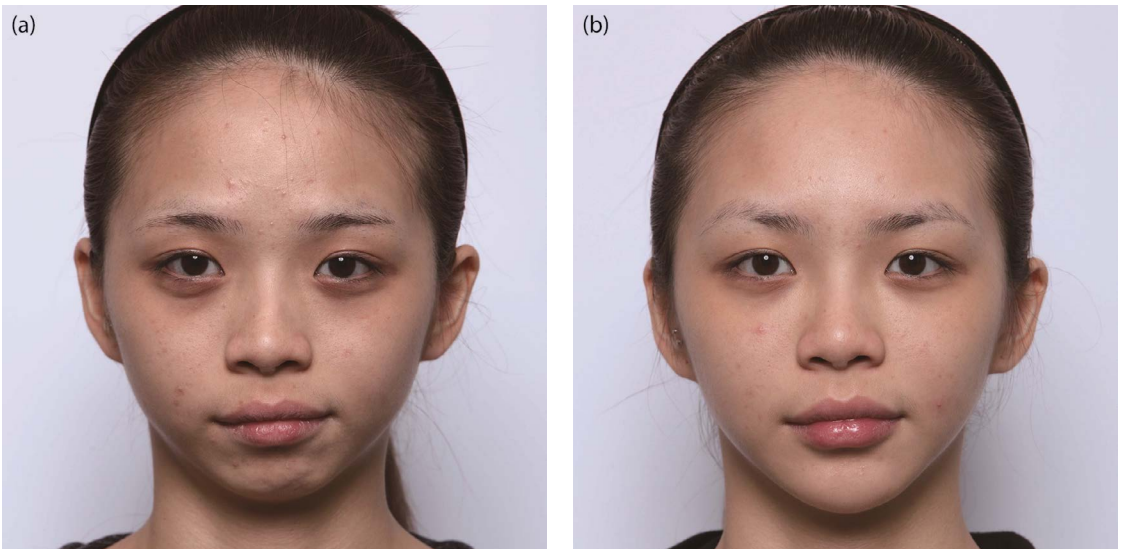

FIGURE 7.8 An underdeveloped maxilla and mandible explain many cases where there is a short long axis. (a) Pre-treatment, this young female shows underdeveloped facial structures below the eye with concomitant chubbiness and severe chin retrusion. Deficiency of the temporal volume contrasts with the orbit rim and breaks the upper full contour. Fullness of the lower cheek contrasts with the infraorbital zone and gives a relative infraorbital pseudohollowness. The nose is small and the lips have deviated. (b) Radiesse is administrated for the forehead and chin to prolong the face for a better shape and ratio. Belotero Intense is injected in the medial cheek, paranasal fossa, and nose to increase the central projection. Belotero Balance is used for correcting some of the unevenness related to crowding. Toxin is used to fortify the adjustment and slimming of the lower face.

7.6.1 Structure and Mechanism

Complete treatment of alignment problems should be accomplished by both craniofacial surgery and orthodontic adjustment. However, many patients are afraid of the invasiveness of surgical procedure and choose to be treated by orthodontic means or by no treatment at all. Injectable fillers could help further enhance the contour in patients who received complete treatments or have camouflaging effects for patients who have been partially treated or not previously treated at all.

7.6.2 Types

Malalignment of the lower facial bone could present as bimaxillary protrusion or mandibular retrusion or protrusion. The occlusion problems would consequently result in type II and type III malocclusion for these discrepancies (**Figure 7.9a–c**). The relative protruding mandible with or without protrusion of the maxillary arch would make the midface appear flat or sunken. In patients with this kind of discrepancy, even when the midface is normal in position, the projection has to be augmented a little to balance the lower face. In the patients with a recessive lower face, augmentation can be done similarly as the treatment adjusting the facial shape on the mandible and/or maxilla, depending on the relative projection. Bony malalignment has to be treated with fillers injected deep to mimic the bony structures (**Figure 7.9d** and **e**). However, changes that depend only upon bone depot could be minimal. Soft tissue augmentation can also be done for the cutaneous lip and mucosal lip to give a hint of the correct soft tissue position. These corrective injections should be kept within the normal range of facial dynamicity.

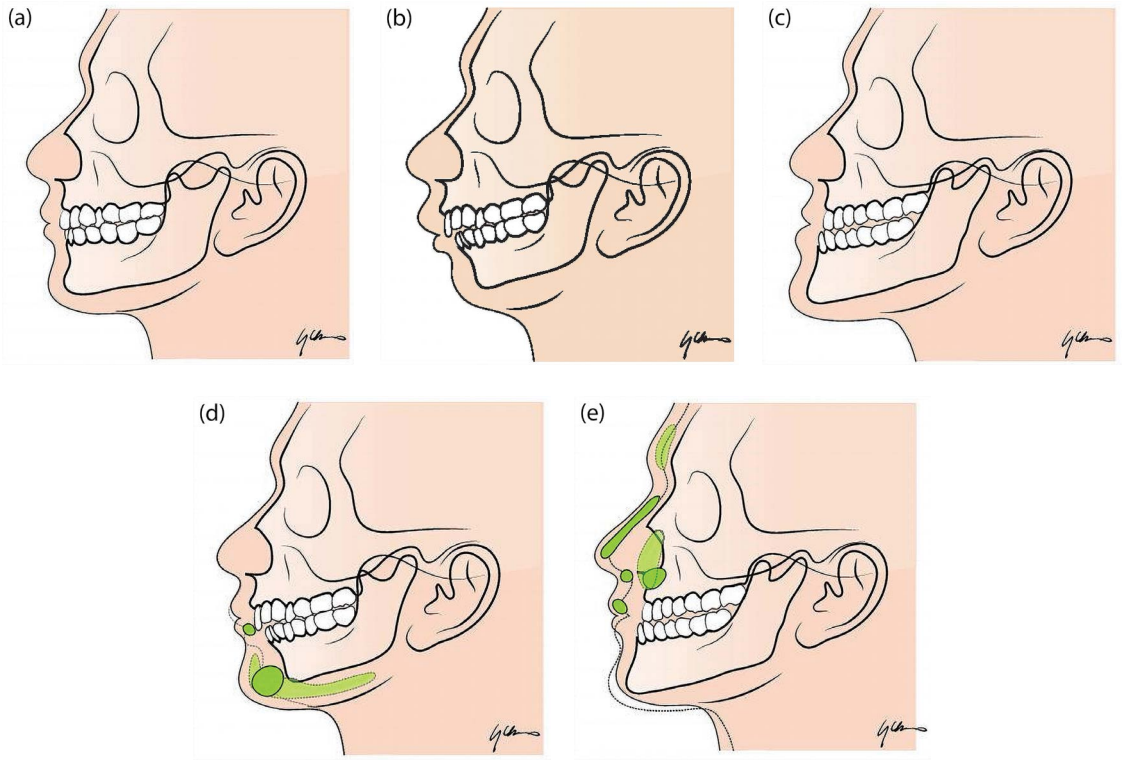

FIGURE 7.9 (a) Malalignment of the lower face could result in the problem of malocclusion and facial dysmorphism. (b) Mandibular retrusion is associated with a shorter facial dimension, smaller lower facial proportion, and inadequate jaw protrusion. Soft tissues are crowded together as excessive chubbiness and the facial shape is usually round in format. (c) Protrusion of the lower face is often associated with type III malocclusion and a flat or concave midface. Soft tissues are usually stretched down and appear deficient. Nasolabial folding and mid-cheek grooves are usually exaggerated. The facial shape is long with often rhomboid ridges. (d) Injection for retrusive cases (as in b) should focus on augmentation to increase protrusion and dimension. (e) Injection for the protrusive cases (as in c) can camouflage the mid and upper face for better balancing.

7.6.3 Selection of Fillers

Fillers to be used for correcting the bony framework should be those with relatively high lifting capacity. PLLA is often used for craniofacial framework modification. Fillers for these highly mobile soft tissues should have better tissue integration characteristics. HA gels, to give soft tissue projection, must be those with higher elasticity.

7.6.4 Injecting Techniques

Different basic and advanced injecting techniques should be adopted in combination for these complex regional works.

7.6.5 Cautions

Injectable filler correction of malalignment problems is more a case of camouflaging than of real structural correction. Injections often have to be multilayered and in a mixed pattern to mimic the local structure and keep the face's dynamic movements natural.

7.6.6 Clinical Effect and Limitations

Augmentation of the midface for balance with the protruding lower face should be modest because the room for injectable advancement is usually limited. Nasal augmentation should accompany the pre-maxillary injection to keep the relative relationship correct. Injectors have to be aware that fillers deposited deep are still fillers separated from the bone. Overfilled fillers could deteriorate in its contours because of the dragging of muscles.

Malalignment of the lower face resulting in facial contour problems can have a great psychological impact on self-image and self-confidence. When orthodontics is done without bone surgery, patients with these problems could be addressed with a strategic augmentation with fillers to give a better esthetic result. Injection should not as well as could not replace the role of surgery or orthodontic treatments but should be added as an adjuvant treatment to achieve a better esthetic result (**Figure 7.10a–c**).

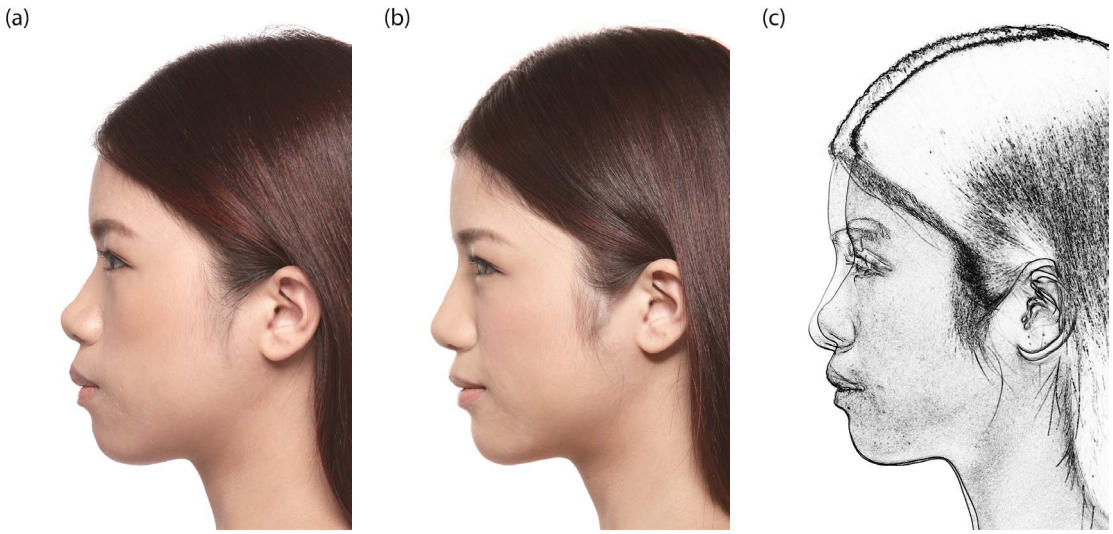

FIGURE 7.10 (a) This young female patient has bimaxillary protrusion appearing concave in the midface. The chin shape is retrusive with a tightly bounding mentalis muscle. (b) Corrective injection is done with nasal augmentation and adjustment of the nasofrontal transition. Midface augmentation is conducted through multiple layers both on the paranasal maxillary bone and in fat compartments. Chin augmentation is done with a towered technique and 3D structuring of the lower cheek. (c) Patients with problems of protrusion are treated with injectables for volume augmentation of the relative deficiency, even though the apparent deficiency could be normal in structural position and volume. These camouflages rearrange the relationships between facial zones to fit better the profile requirement with only a slight change of the facial angle.

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8 Adapting Injection Techniques to Different Filling Materials

Yates Yen-Yu Chao, Sebastian Cotofana, and Nicholas Moellhoff

Contents

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8.1 INTRODUCTION

The industry of injectable fillers is rapidly evolving. In 2018, the market was valued at USD 3.47 billion. Many fillers manufactured under the same process are formulated into different subtypes to fit better into practice dedicated to different injectable treatments. These products within one range differ in concentration, degree of modification, and particle size that endow them with divergent rheological properties to perform differently.

Different manufacturing processes for the same category of filler, like hyaluronic acid (HA), could produce fillers of more diversified characters, while different materials vary much more in performance, tissue reaction, and longevity even when being injected the same way.

The present environment of injectable teaching is more influenced by the commodity industry in terms of teaching, training, and even the concepts about treatments, mechanisms, the underlying science, and applications. Injectors should understand the products they are using more from the perspective of science rather than merely from brochures and seminars, which could be biased for commercial interests. Better acquaintance with different products could help the injector choose the most suitable filler and use it in the appropriate way.

8.2 HYALURONIC ACID

Out of injectable soft tissue filler consumption every year, HA fillers take about 77% of the market share. HA is also the category of filler with the most commercial brands and the most variable characteristics.

8.2.1 Introduction

HA is a natural mucopolysaccharide composed of thousands of linked units. Natural HA surrounds extracellular spaces, including dermis and fibrotic structures, providing support and transmitting signals. Being highly water soluble and structure flexible, HA can easily fill in tissue spaces, providing hydration and cushions.

HA products nowadays are mostly synthesized from *Streptococcus equi* fermentation and purified by alcohol precipitation. Though basic HA units are not organ- or species-specific and are believed to be immunologically inert, hypersensitivity reactions have been reported. Injectors should refrain from using HA products in patients with a history of hypersensitivity to Streptococcus, Gram (+) bacteria, or lidocaine.

Commercial HA filler products are generally manufactured using 1,4-butanediol diglycidyl ether (BDDE), divinyl sulfone, or 2,7,8-diepoxyoctane (DEO) cross-linking to prolong their clinical effects and build their physical properties. Cross-linkers, though believed to be harmless to human beings, have changed the HA to be different from the natural ones. The degree of modification is related to certain physical properties of stiffness and hydrophilicity. Over-linked HA products have been found to elicit an immune reaction and nodule formation.

According to the different manufacturing processes, cross-linked HA gels have to experience the sizing or homogenization process to become injectable materials that can pass through the lumen of needles. Sieving produces small HA particles in different sizes that have a minor impact on their physical properties when these particles stack together, pass through needles, and are situated in extracellular spaces; their impact on degradation time is limited. However, when they are situated between tissues, HA gels of larger particles could be more stable in loose tissue but visible when injected superficially.

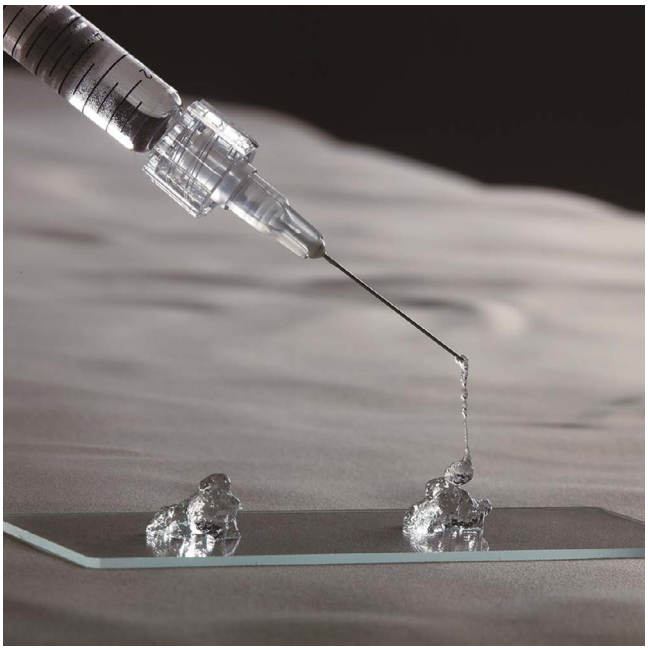

FIGURE 8.1 The physical properties of an HA product can be observed during the process of extrusion and by the way, they stack and maintain cohesion out of the syringe.

The step of homogenization varies along with the original HA molecule size and amount of cross-linker and polymer conformations, resulting in different homogeneity, percentage of cross-linkers, intermolecular affinity, status of water equilibrium, and also the ability to integrate with the tissue (**Figure 8.1**). These softer products are also composed with free HA to maintain fluidity, and are not really monophasic but have wider range particle sizes.

These volumizers increase tissue volume by staying between tissues and inflating as a collective structure; they are the prototype of an injectable filler. They are the so-called linear fillers since there is a minimal tissue reaction between these filler materials and body tissue except for space occupation. Fibroblast stimulation – though it has recently been claimed after HA filler injection – is very minimal and this could be the tissue response to the injection tissue disruption.

8.2.2 Rheological Properties and Classification

Rheology of these semiliquid filler substances has been extensively discussed to explain the behavior and property of a filler when it passes through the syringe and needle and its clinical effects in tissue. This can help the injector to choose the right product and apply it with the correct technique. The values of G′ (elastic modulus) and G″ (viscous modulus) as shearing stress parameters, and similar parameters under compression stress of E′ (elastic modulus) and E″ (viscous modulus), have been described and are believed to be equally important in providing lifting capacity.

The cohesivity of the filler is the tendency of the material to remain together under stress but is less defined or agreed with any consensus on the way it should be measured. This is the affinity between molecules and is believed to be important for fillers indicated in mobile regions. Flexibility is another term coined by some manufacturers about the allowance for materials to deform. Fillers of higher flexibility could perform better in regions of higher mobility. Along with viscosity and the degree of tissue integration, these characteristics are related to malleability and the tendency to creep.

The rheological property of an HA filler product is the result of the interplay of the HA manufacturing process, raw material size, concentration, types of the cross-linker, sieving, and added ingredients, including free HA. The clinical longevity, tendency for swelling, and tissue reaction are also related. The term "soft gel" has been described as a group of HA fillers without a well-defined particulate texture and is understood as monophasic. Fillers of this category can be administrated and modified after injection for redistribution. In general, HA filler products with higher efficiency of modification are physically stiffer and have to be targeted precisely because of their limited dispersion.

Fillers are commonly placed within facial soft tissues, which constantly move during speaking, eating, or the display of emotions. Recently, it was investigated whether the fillers' viscoelastic properties can be affected by different testing frequencies, to gain insight as to whether physicochemical properties of fillers remain constant after injection into moving tissue (i.e., lips or medial midface). The results revealed that the viscoelastic properties were not stable but were indeed influenced by the shear forces determined by the frequency applied during testing. An increase in G′ was observed for all investigated fillers with increasing frequency in the transition from "soft" to "hard". Interestingly, depending on the product investigated, an increase or decrease of G″, corresponding to a respective decrease or increase of fluidity, was observed with increasing frequency, emphasizing the importance of product choice and knowledge of the product's physicochemical properties prior to injecting.

The detailed comparison and interplay of these rheological characters of HA fillers are beyond the scope of this book. HA fillers with different physical properties should be indicated for different purposes and injected through different techniques.

8.2.3 Clinical Indications

HA fillers as the mostly used injectable fillers are used in all kinds of indications. The selection of HA fillers should be adapted to the targeted tissue characteristics. When fillers are to provide shape or support, the lifting capacity should be considered with higher elasticity. Soft tissue volume restoration can be achieved both with softer gels and stiffer granules but should proceed differently. Tissue integration can be achieved both in the affinity between the material and tissue molecule and by the partition between tissues. Injectors should be aware that the affinity between fillers and tissue is very limited. For superficial injection above the mimetic muscles or the injection in highly mobile regions, HA selection should focus on the extensibility of the material, or in other words, the cohesivity and flexibility. Superficial injection for skin texture should choose fillers that are smaller in particles or softer in texture (**Figure 8.2a** and **b**). HA filler correction is more like foreign gel insertion mimicking self-structures. Any attempt should not exceed the carrying capacity or integrating ability of the self-tissue.

8.2.4 Injection Techniques

Injection techniques have been developed to protect the procedure from dangers, deliver the parcels of HA precisely, and not interfere with the distribution of fillers and the final results. These considerations would lead to different choices for HA products of different characteristics. Though redistribution is possible for some softer gels, the best result still requires the allocation of instruments to appropriate points and depth and fine distribution in aliquots. Compared with soft gels that have a higher affinity to integrate with tissue, fillers of a targeted distribution pattern should be used with caution to avoid migration via the instrument channels or being injected in ways allowing them to pool together.

Molding is important for HA injections immediately after the procedure and days after to facilitate better tissue integration and more correct contouring.

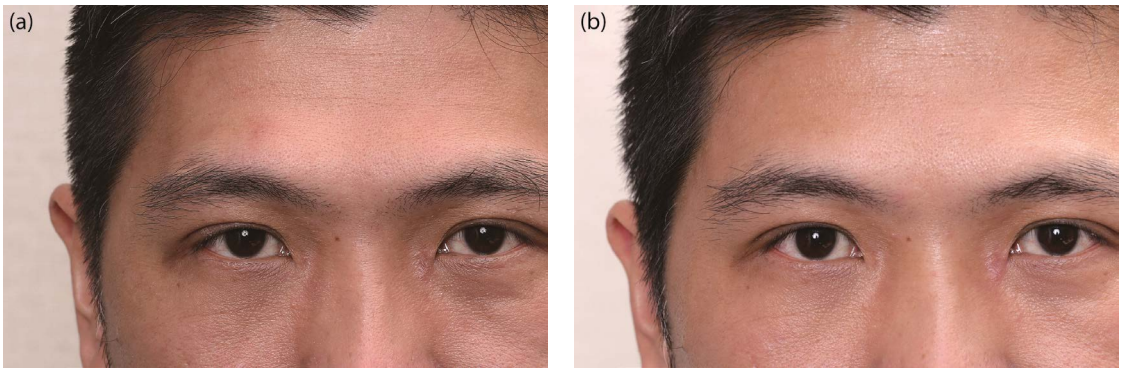

FIGURE 8.2 Superficial injections are usually accomplished with softer gel HA or small particle HA. (a) Restylane Skinbooster is used in this male patient for the adjustment of lateral forehead contour. Superficial deposition of the particulate HA proceeds through multiple superficial punctures to limit the range and thickness of filler distribution. (b) Two weeks after the injection, HA has successfully broadened the forehead and improved the curve of forehead-temple transition with very natural merging at the borders.

8.2.5 Advantages and Limitations

HA injection is adjustable after implantation and erasable by hyaluronidase. Technically, it is easier and more accessible for the injectors. However, the great variety of HA fillers is rather confusing for injectors. Inappropriate selection of items and incorrect techniques could add unnecessary volume without the desired effect. HA gels should be understood as less fixed in tissue both in distribution and in shape. Great after photographs could look good only shortly after injection but fillers could collapse or creep weeks afterwards (**Figure 8.3**). Injectors should try to understand a product based more on its scientific data than on the marketing materials.

FIGURE 8.3 An unknown HA product has been filled in this female patient for the correction of the infraorbital grooves. She was happy initially for the flattening of these grooves but concerned about the linear lump after several weeks. The HA substance had crept and was grouped together after repeated muscle exercise.

8.3 CALCIUM HYDROXYLAPATITE (CaHA)

The esthetic filler using CaHA – Radiesse – was approved by the Food and Drug Administration (FDA) in 2006 for wrinkles and HIV lipodystrophy. CE certified it 2 years before that. CaHA is unique in its high elasticity/viscosity and the physical character, allowing dilution with saline or lidocaine.

8.3.1 Introduction

CaHA is an inorganic compound. Synthetic CaHA microspheres are biocompatible and degradable. The commercially available filler product (Radiesse, Merz Inc, Germany) is composed of 30% of CaHA particles, 25–45 μm in diameter, suspended in an aqueous glycerin and sodium carboxymethylcellulose (CMC) carrier as a gel. Before esthetic approval, it was used for vocal cord augmentation, radiological marking, and oral/maxillofacial defects augmentation. Because CaHA is identical in composition to the mineral portion of bone and teeth, immunogenicity is negligible. No heterotopic bone formation was found in animal studies and clinical use but CaHA was found to stimulate collagen and elastin formation.

8.3.2 Rheological and Product Features

CaHA is characterized by its high elasticity, high viscosity, and high cohesivity. Compared with HA fillers, CaHA provides stronger contouring capacity and better lifting strength for shaping projective contours and supporting sagging tissues. It is good for areas that need definition and patients who have thick heavy faces.

The elasticity of the filler compels it out of the needle and that is why injectors observe spontaneous flow out of the needle without hand pushing. The viscosity of a filler lets it stay where it is and hinders its spread or the possibility to be molded. These characteristics elevate the threshold for using it.

8.3.3 Dilution Versatilities

CaHA dilution with lidocaine was approved by the FDA as not interfering with its physical properties. However, that is based on studies with 10% v/v aqueous diluent. The CMC in the CaHA product – the major part inside per syringe – is hydrophilic and provides suspension for the CaHA particles. The CMC-based gel can be diluted with a larger amount of lidocaine or normal saline to get a homogenous mixture; increasing numbers of techniques vary the dilution to 1:1, or even thinner, for wider spreading and more exposure to the tissues. Diluted CaHA has been used for different purposes, including dorsal hand rejuvenation, neckline correction, biostimulation, forehead augmentation, and flexible contouring. The diluted substance retains more elasticity but is thinner in viscosity and can provide a bigger amount to cover a bigger area, be more malleable (**Figure 8.4**), become thinner and more suitable for delicate deployment, achieve more even distribution and more tissue exposure, and have the benefit of being compatible with hydrodissection fluid.

8.3.4 Tissue Reactions

The injection sites of CaHA have been found to have increased fibroblast, type I and III collagen, elastin, angiogenesis, and inflammatory cells. Imaging studies show thickening of the skin and increased volume compatible with improved contours and tissue mechanical properties.

FIGURE 8.4 Diluted CaHA can be indicated for both biostimulation injection and recontouring purposes. Thinning of the highly viscous material allows for remodeling after injection.

8.3.5 Injection Techniques for Different Indications

The cannula technique has been widely used for CaHA enhancement, especially for biostimulation and soft tissue contouring. The purpose of the cannula is to enable the filler to travel to a more specific point in tissue instead of redistributing it by molding and spreading (**Figure 8.5**). Hydrodissection of the forehead and dorsal hand area is both aimed for protection and preferably accomplished with a cannula. However, as for projection and precise contouring, needles should be considered for better flexibility and a more pointed effect. The neckline is the indication that needs very superficial placement and a very delicate deposition, which has to be performed with needles. Biostimulation of the trunk and limbs usually has to cover large areas and encounter dense dermis, as in the knee; needles are preferred to give more homogenous results and be more efficient in reaching superficial areas (**Figure 8.6a** and **b**).

FIGURE 8.5 Precise distribution of fillers should be achieved by proper placement of injection materials that can rely on multiple penetrations by the blunt cannula in tissue to decrease vascular damage.

FIGURE 8.6 (a) Layering of 1:1 diluted Radiesse has been applied in this elderly woman for biostimulating the lower face loose skin. (b) Belotero Intense augmentation provides support on the brow and cheekbone, giving a lifted appearance.

8.3.6 Advantages and Limitations

The strong lifting capacity surpasses that of softer line filling gels, defining precisely facial contours and counteracting the pressure of overlying tissue and dependent sagging. Nontransparent materials will not scatter light. After the resorption of the initial diluting contents, the filler material is usually fixed in a location without any tendency to migrate or deform (**Figure 8.7a** and **b**).

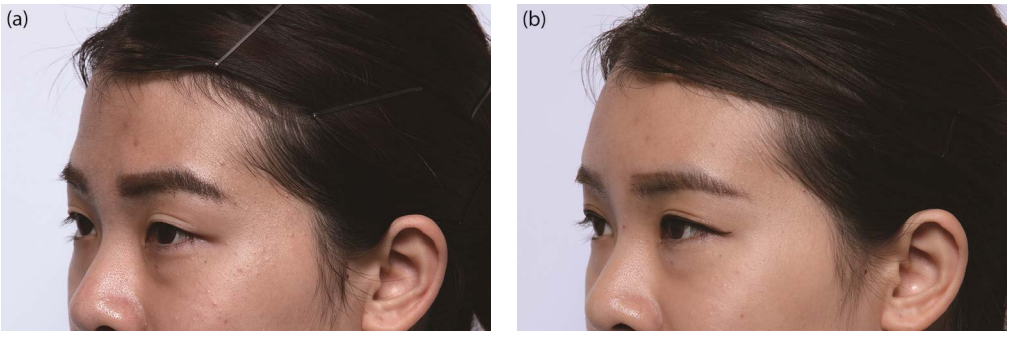

FIGURE 8.7 (a) Radiesse (3 ml in total) is used for the whole forehead with the facilitation of saline hydrodissection for creating a more convex forehead profile. (b) A differential amount of Radiesse has been placed in the subgaleal space with a natural gradient from the center to a frontotemporal junction. The gradient of Radiesse is somewhat fixed and not deformable after solidification, several days after injection.

The shortcomings of CaHA are the relatively short clinical effect, the higher requirement for the injecting technique, no applicable antidote, the longer resorption time of the residual particles, and fibrotic change after tissue stimulation which makes it more challenging to undertake subsequent surgery and secondary injection. An in vitro and cadaveric study investigated the intra-arterial disintegration of CaHA after trans-arterial application of sodium thiosulfate, revealing only limited potential and demonstrating the lack of a suitable antidote for dissolving the product.

8.4 POLYCAPROLACTONE (PCL)

Injectable polycaprolactone (PCL) was approved in 2009 in Europe and 2013 in South Korea and Australia. Because of its collagen stimulating potency, it is often marketed as the next generation of injectable poly-L-lactic acid (PLLA); however, the format of filling material, working mechanism, and injection techniques of PCL are all very different from those for PLLA.

8.4.1 Introduction

PCL is a biodegradable polyester that can be degraded by hydrolysis of its ester linkage into hydroxycaproic acid and water. PCL has been widely used in the medical field as an implant, suture, and drug delivery device. The shortcoming of PCL is its low melting point (59–64°C) and poor mechanical property; that is why CaHA was added as a mixture for devices. Commercially available PCL filler (ELLANSÉ, AQTIS Medical, the Netherlands) consists of 30% non-cross-linked PCL microspheres (25–50 μm) and 70% aqueous CMC gel carrier with phosphate-buffered saline and glycerin and is available in four versions.

8.4.2 Rheological and Product Features

CMC gel is the carrier and is 70% of the whole product. The CMC gel provides certain cohesivity, viscosity, and elasticity. Compared with CaHA gels, the particles of CaHA are stronger in mechanical property. PCL filler products are softer in physical strength and have to be in a higher concentration of CMC to maintain homogeneity and are less suitable for dilution. PCL product ranges differ in duration of effect but not much in physical property.

8.4.3 Tissue Reactions

PCL, like CaHA, stimulates tissue to replace the volume of the resorbed CMC gel. The mechanism of PCL biostimulation is similar to that of CaHA and both of them consist of smooth spherical particles similar in size. Differences exist between the two in the severity of tissue reaction and speed of their hydrolysis – in other words, clinical longevity. Under the microscope, eosinophils were found in PCL-induced tissue inflammation but not in CaHA injection. The foreign body reaction of PCL is a little stronger than that of CaHA but less than that of PLLA (**Figure 8.8**). PCL stays in tissue longer – especially the longer duration versions of L and E. In the author's experience, reactive nodules are found and reported more often and tend to be from products of longer duration, while CaHA nodules are more often cases of aggregate nodules due to poor technique. The postinjection reactions of swelling and redness are also similar to those of CaHA and last a little longer.

FIGURE 8.8 PCL has been injected in a similar way as CaHA or HA but is believed to have more tissue growth through tissue stimulation and reaction. Persistent erythema has been noted after the injection of PCL under the eye and in the medial cheek. That symptom persists for some time, with a progressive uncomfortable bulging sensation one month after the procedure.

8.4.4 Injection Techniques for Different Indications

The injection techniques are more like those for CaHA by needles or a cannula. However, the technique for diluted CaHA is less applicable for PCL because when a hydrophilic substance is added into the PCL mixture and takes a major part in the proportion, the hydrophobic characteristics of the PCL particle will make it more resistant to the suspension function of the CMC. When there is a long delay after mixing and before injection, the mixture is about to separate and can cause a problem with uneven distribution in tissue.

With the characteristics of being softer, less cohesive, and less elastic, PCL can be indicated and easily used for soft tissue augmentation, whereas CaHA is preferred to be pre-diluted for soft tissue application. PCL gives a softer definition (**Figure 8.9**) and projection when compared with CaHA. Pure PCL injection is painful; 10–20% of lidocaine is suggested to be added per PCL syringe to smoothen the procedure. The injection technique is similar to that of HA fillers but the distribution and augmented volume appear more fixed than with HA gels. The lifting capacity of PCL is also in the range of HA fillers.

8.4.5 Advantages and Limitations

PCL filler products have prolonged duration when compared with HA products and CaHA. The advantages of nontransparency and the fixed effects after implantation are similar to those with CaHA; there is no antidote either. Injection techniques are more like those for HA fillers and more accessible for those starting as injectors. The limitation of PCL is the low melting point; energy-based device treatments should be used with caution on faces filled with PCL.

FIGURE 8.9 (a) This young female, presenting with a tired-looking and flat front face, is treated with injectable PCL enhancement. (b) Ellanse S is used for the forehead through a diluted cannula technique, the temple, nose and chin by needles, and the cheeks with a cannula. The photograph 2 weeks after the injection showed the satisfactory smooth transition between compartments and fuller curves all around. The projection and ridges created by PCL are noted to be round as well.

8.5 POLY-L-LACTIC ACID

Injectable PLLA has been marketed in Europe for about 20 years and was approved by the US FDA for HIV-associated facial lipodystrophy in 2004 and esthetic use in 2009. Injectable PLLA can be understood as an activating filler different from linear filling substances in mechanism, format, and injection technique.

8.5.1 Introduction

PLLA is a synthetic biocompatible and biodegradable polymer of L-enantiomeric lactic acid. Lactic acid polymers have been used safely in medicine for three decades. They degrade and will be excreted as carbon dioxide and water. The cosmetic commercially available PLLA – Sculptra (Galderma Laboratories, L.P., Switzerland) – is supplied as a lyophilized powder in vial packs complexed with mannitol and sodium CMC. The PLLA microparticles, ranging from 40 to 65 mm in size, are not deformable like HA

and not spherical like PCL or CaHA. Injectable PLLA has to be reconstituted with sterile water, which acts as a carrier of these particles. PLLA particles are not water soluble and tend to aggregate with each other. The CMC inside each vial suspends PLLA particles temporarily and limitedly, depending upon its concentration (the amount of reconstituting water) and the presence of lidocaine. Vigorous agitation has been shown to have an equal effect of de-aggregation as 2 to 7 days of standing. The injection has to be administrated with 26-gauge (or thicker) needles. The different physical properties of the watery complex should be considered for modifying means of injection to achieve better results.

8.5.2 Tissue Reactions

The mode of PLLA action has been studied and proved to be a foreign body reaction underlying the augmenting effect. The biostimulation process includes protein absorption, cell recruitment, and fibrotic encapsulation. Macrophage, fibroblast, and consequent type I and type III collagen are involved in the whole picture for increasing tissue volume, strength, and local metabolism.

8.5.3 Clinical Indications

PLLA restores facial fullness in large volume for patients with lipodystrophy, but the old standard of reconstitution and injection path has always produced nodules. PLLA is now popular for esthetic uses in North and South America and Asia. The ways of application and popular indications vary between different regions. Bony frame correction or augmentation is more focused on aging symptoms in the United States, whereas contouring and soft tissue enhancement are often treated and requested with PLLA for young patients. Skin quality and body uses are popular for Brazilians. The combined volume gain and improvement in tissue quality could flexibly be applied from supraperiosteal space to dermal tissue, including scars.

8.5.4 Reconstitution and Different Formula

PLLA reconstitution evolved from 3 ml two decades ago to even four to five times more in some current guidelines just for the purpose of prevent nodule formation and placing the PLLA particles more evenly. However, PLLA particles are water insoluble. The homogeneity of the PLLA solution is dependent on the suspending capacity of CMC. The over-elevation of water content inside each bottle will not increase the distribution homogeneity of PLLA particles in tissue and inversely could hamper the control of dosing during the injection.

When reconstituted in the solution of 5 ml water, PLLA particles gradually precipitate. Whitish sediments can be seen several minutes after it is left still to stand. PLLA sediment forms more rapidly in a more diluted solution; the fluid is separated in less than one minute in syringes and vials. If assistants did not keep mixing the vial, the extracts within different syringes could be different in concentration; the injector could also deliver half of the syringe thicker and the other half thinner. Sediments could result in more needle clogging; and bilateral injections could become asymmetric. That makes injection more challenging and less predictable, especially when the injection cannot be performed quickly enough or finished in time (**Figure 8.10**).

8.5.5 Injection Techniques and Clinical Effects

Injectable PLLA presents in the form of a liquid substance. Though the injection process looks similar to those for delivering gel-form materials, the rheological difference necessitates adjustments in injection

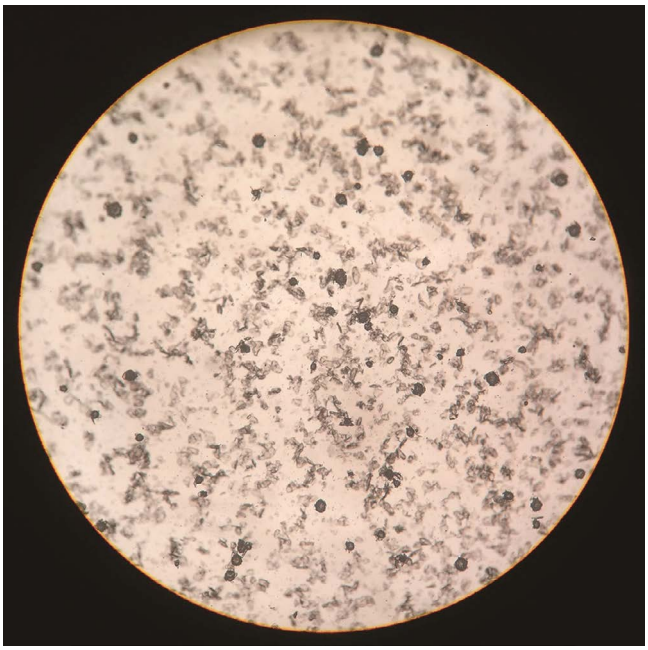

FIGURE 8.10 PLLA particles are insoluble and tend to adhere to each other. Preparation hours before the injection break the tight aggregates. This is the reconstituted mixture 30 days after the addition of water. The crystals present in similar sizes as the fresh sample that is examined minutes after reconstitution, with an irregular spiked shape, and adhere to each other.

techniques (**Figure 8.11**). The resistance between the filling material and the needle and the force for deforming HA particles through the instrument lumen are important for controlling the filler flow. The problem for injecting a watery filler is the propensity of a liquid to come out of or drop off the needle without much effort, especially when the instrument lumens are large. Both pushing and holding the plunger are equally important throughout the process. Furthermore, the force and steadiness of thumb pushing

FIGURE 8.11 The injection techniques of PLLA are more skill sensitive as regards control of flow, depth of insertion, size of aliquot, and pattern of distribution. Needles are more precise at delivering liquid-form substance and more flexible for reaching different layers and spots.

FIGURE 8.12 (a–d) Progressive improvements in skin texture, volume increment, and contour changes are appreciated by patients through tissue reaction and tissue growth. These photographs record progress in one year after three sections of Sculptra injection. Initial uneven surface, loose skin, and volume deficiency in multiple areas were improved by the injection and progress is obvious.

is extremely important. The liquid character of the filler carries the benefits of more effective aspiration examination before injection, easier remodeling by massage, and less concern for vascular obstruction but can also challenge the precision of deposition, flow, and the efficacy of giving projection or definition. Compared with gel injection, the injection of PLLA should proceed more quickly. Needles are superior to the cannula for better precision and flexible access to different locations and layers.

The clinical effect varies from providing bony framework modification, soft tissue volumization to skin quality changes, depending on where PLLA is implanted.

8.5.6 Advantages and Limitations

Tissue reaction and volume formation take time and the improvement is progressive (**Figure 8.12a–d**). That is more preferred for professionals and public figures who can't have sudden changes on their faces. New tissue is continuous with self-structure, different from tissue integration, and fixed with tensile strength. Stimulation and tissue formation are sustained longer, so that a refilling injection is required less frequently.

The limitations of injectable PLLA include a higher requirement for skills of injection and a more knowledgeable understanding of anatomical and morphological problems of the face, because PLLA is often indicated for the whole face for pathognomonic reasons (**Figure 8.13a** and **b**).

FIGURE 8.13 (a) The improvement of PLLA injection is more low-key and less well-defined in certain points because its changes are deep, through an increase in self-tissue and the pattern of fixed, connected new volume. That allows more a pathognomonic correction and holistic approach. (b) Two sections of Sculptra injection improved this young female patient with more coherent fullness and better tightened fullness. Focal correction can be spotted in the forehead, tear trough area, and jawline, with natural merging with original curves.

Initial plumping with water does not determine the final pattern or amount of volume. Tissue trauma and bleeding could distort the shape with volume; poorly prepared solutions containing only water could also inflate the tissue temporarily.

Treatment usually requires several sections. The second treatment is usually delivered before the final effect of the first on tissue has become clinically evident, so the second and the successive injections have to continue the partially finished work relying on visualization, more in the manner of an artwork being executed according to the overall conception of an artist. Precision and smoothness in procedure can be achieved with more experience; and bleeding and needle clogging happen much less with experienced injectors.

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9 Adapting Injection Techniques to Different Genders

Yates Yen-Yu Chao

Contents

9.1 INTRODUCTION

Sexual dimorphism is one of the key factors of outward appearance that are generally believed to be regarded as attractive. Facial traits relating to sexual dimorphism have been studied both in anatomical and in morphological ways. With injectable fillers, these forms of shape could also be adjusted or enhanced. Many injection procedures delivered by practitioners or requested by patients – even though they are often

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in the name of antiaging or rejuvenation – carry implications for masculinity or femininity restoration and have to be approached differently for males and for females. However, similar principles and techniques have usually been taught and administrated without addressing these specific considerations.

Incorrect results occur more on male faces because female patients form the majority of the aesthetic medical market and most teaching, training, and studies are based on an understanding of female features. It is not rare in the clinic or in the media to see male patients with perceptible changes that have somehow feminized them or at least not improved their appearance in terms of masculinity. Compared to female aesthetics, male patients show a broader variety of styles and personal preferences. Injectable treatments have to target the patient's personal temperament, with awareness of sexual traits in morphology, and give the right doses of feature enhancement accordingly. Injection of fillers is highly artistic and never an easy job that can be achieved simply by following some standard protocols.

9.2 THE SCIENTIFIC BASIS OF SEXUAL DIMORPHISM

Animal reproduction starts with selecting mates and the selection – or, to put it technically, motivational salience – relies on the attractiveness between both genders. Signals of attractiveness could be delivered in the forms of smell, sound, color, and shape (**Figure 9.1**). The morphological divergence between genders is associated with developmental maturation governed by hormones and genes.

9.2.1 Zoological Sexual Dimorphism

The morphological divergence between males and females within the same species can present in shape, color, size, and/or structure. Most of these expressions of traits are inherited, and some can be attributed to environmental factors. For example, female birds are usually colored in a cryptic way to be concealed, while males are usually more colorful for displaying courtship and territorial rituals. Female creatures often show a preference for exaggerated male secondary sexual traits in mate selection.

FIGURE 9.1 Nyala is a spiral-horned antelope native to southern Africa showing prominent sexual dimorphism. Female nyala weigh about 58 kg and have a shoulder height of about 92 cm; males are 106 cm tall, carrying a horn about 60–83 cm long with a weight of 98–125 kg.

9.2.2 Mechanism

Different mechanisms have been proposed as the models that work behind the developmental differentiation between genders. Genomic signals, endocrine functions, foods, behavior interaction, etc. play out via encoding in genes and are attributed to evolutionary selection; the selection preference has also been proposed to be genetically coded as well.

9.2.3 The Biological Basis for Attractiveness

The mate-quality hypothesis has been proposed based on an evolutionary perspective. Sexual morphologic traits are dependent on hormones during development, so the preference for mates with stronger sexual dimorphism is the biological instinct to choose the ones who have experienced better development and therefore the ones likely to have better fertility and immunocompetence. That could be understood as similar to the theories about the preference for symmetry and an "average" appearance.

9.2.4 Psychological Reasons for Being Attracted

The other school of thought looks in the perceptual direction, regarding the preference as a by-product of cognitive function distinguishing between the opposite sexes.

9.2.5 Studies and Clinical Observations

Some studies have found that the sexual dimorphism is prioritized over symmetry and color as the preference for attractiveness. Sexual dimorphism is more important for male faces than for female faces; however, the dimorphism preference is also more complicated with male faces. Sexual dimorphic cues are associated with some social attitudes and behaviors. In women, facial femininity is associated with cooperativeness, compassion, and honesty. However, in men, facial masculinity can be linked with the perception of dominance, unstable relationships, and violence. As some studies reveal conflicting results, the varying preference of females for male facial masculinity may show that different people resolve differently the trade-off between the preference for indirect genetic benefits and the preference for more immediately socially valued traits.

9.2.6 Cultural Factors

Sexual dimorphism expresses itself in humans not only in the morphological facial traits but also in the voice, physique, and behavior. Culture has great impact on group preference for dimorphism and the stereotypes of what is regarded as sexiness. The currently dominant global fashion industry ideal (what we may call the "Hollywood" ideal) depicts ideal male and female shapes differently when compared with several decades ago. Breast, muscles, jawline, and lips are emphasized more than before and iconic celebrities in the media often show size in these areas that is much bigger than natural development could plausibly have produced.

9.3 FEMALES

A total of 95% of gender features can be identified by the shape of cranial bones in forensic medicine. Cranial bone patterns present sexual dimorphism from deep within the body, deciding most of the fundamental frame and our facial shapes. Many injectable procedures done in female patients are related more

or less with femininity. For most injection enhancing sexual dimorphism, the dose of fillers and the extent of feminine features must be moderated according to the patient's personality, preference, and age.

9.3.1 Morphological and Structural Features

The outward shape and facial contours of a woman when compared with same-age males include better forehead roundness, a more vertical-oriented profile, a less prominent brow ridge, and smoother elevation of the brow area, a smoother transition between the brow and forehead, less ridge or prominence of the glabella, and a smaller and thinner nose. The ideal female nose is a little elevated, with a nasolabial angle around 95–115 degrees. There are fuller cheeks with more fat storage and a smoother transition from zygomatic arch to chin; a less prominent orbital rim and a smoother transition from the temple to forehead, without obvious temporal lines; a soft curve over the cheekbones and mild convexity in the upper portion of the midcheeks; fuller lips, showing defined borders and philtrum columns; a little eversion of the lips, showing the lip fat as tubercles; a retruded midface and a more retruded lower face; and a tapered chin pointing in a more inferiorly anterior direction with a narrower mandible and less prominent mandibular angles.

9.3.2 Key Points for Enhancement

The most important areas for femininity enhancement include the lips, cheek fullness, chin, and forehead-nose complex. Injection treatments also have to obscure prominent ridges and enhance smoothness, improve skin quality, add moderate fullness, correct profile angles, and fill gaps and hollows (**Figure 9.2**).

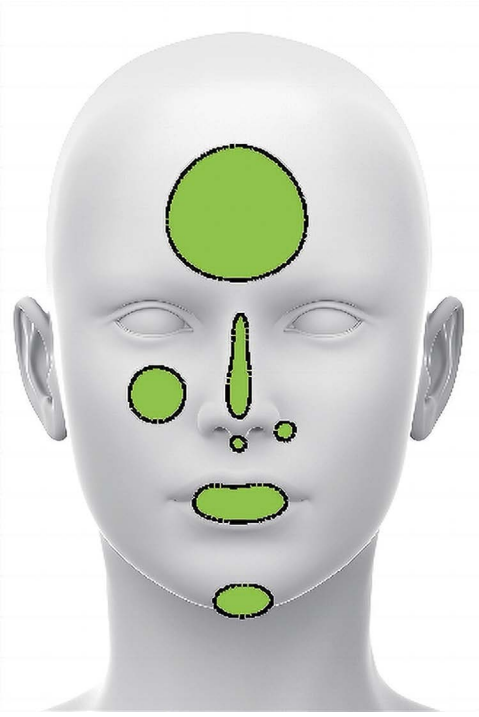

FIGURE 9.2 A strategy for enhancing femininity aims to fortify female traits and decrease any opposite features. Midline augmentation is the most noteworthy feature that narrows the face in visual impression. The forehead, nose, and chin, which are the highlights of a profile projection, can be adjusted by filler injection. Softening of the curves by volume augmentation can be carried out to camouflage rough ridges.

9.3.3 Injection Techniques for Femininity

Compared to injection for males, female treatments should focus more on the amount of soft tissue amount and the distribution and gaps between compartments. In terms of contours, the aspects to be aware of are the fullness, smoothness, proportion, curves, and zonal transitions (**Figure 9.3a–c**). These soft tissue augmentations, compared to structural strengthening or framework building, are more targeted at fat compartments, more superficially. For superficial enhancement or feminizing injections, the filler should be administrated more according to morphological locations than dictated by pathognomonic points. Superficial augmentation usually employs hyaluronic acid (HA) products that are softer and more pliable. HA should be divided into different aliquots instead of a single bolus when the deficit is large to confront tissue mobility by better merging with tissues.

Deep bony framework correction is important for structural transformation or enhancement. The morphological pattern of forehead profile, glabella, brow, and transition to temples is bony in character. That means the modification of these shapes with soft tissue fillers must somehow approach the tissue deeply. The hydrodissection-assisted technique is valuable for correction (see Section 4.3). The cheekbone, brow elevation, maxillary support, chin, and jawline are the features of masculine identities that are equally important in female cases. Injectors should be aware of the difference in patterns to avoid making them too strong. Dimension, thickness, and extent of projection should all be weighed carefully (**Figure 9.4a–c**).

9.3.4 Choice of Filling Substances

Softer gel HA could be considered in order to create smoothness and fullness and improve the quality of the skin. Softer gel HA should not be applied in a single layer when volume replacement is intended,

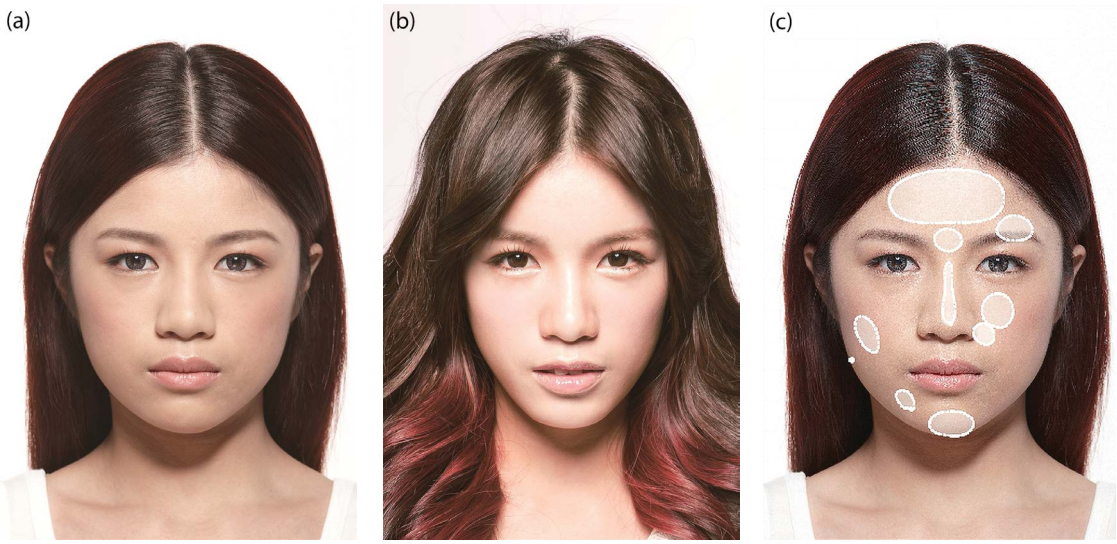

FIGURE 9.3 (a) The face of this young female has a flat frontal aspect that can be perceived in the forehead and cheek. The protruding maxillas contrast with the midface and nose, making them retrusive and flat. The wide cheek and mandible is opposite to the usual narrow and small female configuration. The maxillary protrusion also conflicts with the expected vertical orientation of a female profile. (b) Radiesse is used in this case to adjust the paranasal maxilla position and chin projection. Toxin works on the masseter, slimming the lower face. The cheek and forehead are camouflaged by augmentation in the medial and lower face to draw attention to the center. (c) The whitish circles label the injection plan.

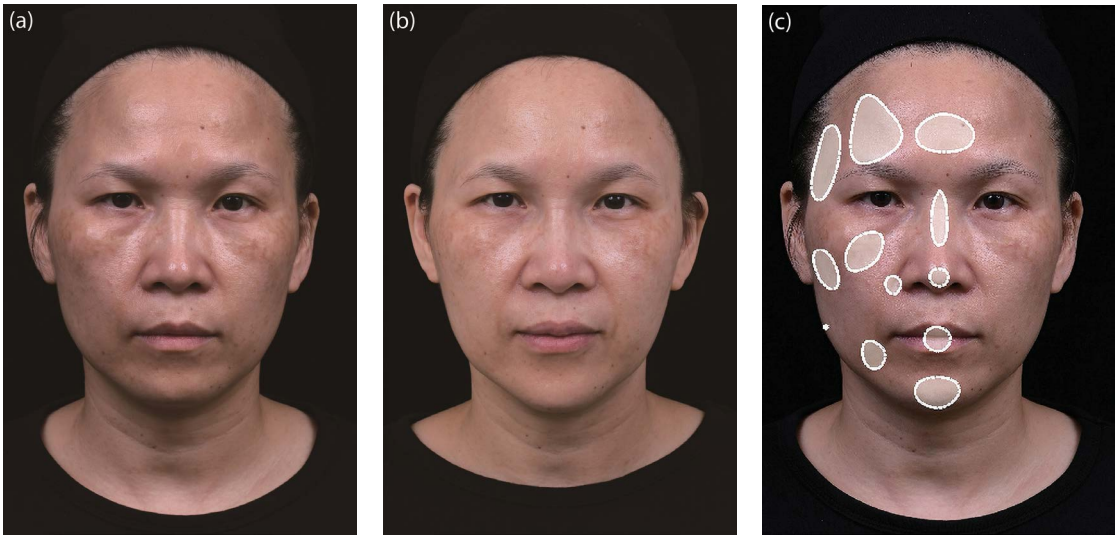

FIGURE 9.4 (a) This elderly female has some problems that could be adjusted for better femininity. The upper orbital ridges stand out with a wide gap to a female-patterned frontal bossing. A wide cheekbone is common for Asian patients. However, the width and ridge contrasts with the central concavity and roughness. The cheeks presented in an angular manly pattern need curve and volume. (b) Sculptra was administered in two sections to soften the bony transitions and fill some of the gaps. Restylane range is used for the nasal augmentation and the lips. The photograph after 2 months shows moderate improvement halfway through the process. (c) The whitish zones mark the treatment undertaken.

especially when the deficit is large and the volume problem is accompanied by tissue laxity. Soft tissue enhancement sometimes is preferably defined – for example, the tubercles of the lip and vermilion borders. HA products with higher elasticity define borders better with their targeted distribution pattern. HA products with a swelling tendency or nonhomogeneous in texture should not be used in the periorbital region. Poly-L-lactic acid (PLLA) is possible for the strengthening and thickening of the superficial soft tissue envelop by stimulating self-tissue growth and creating the look of softness and smoothness. Superficial application of PLLA is possible but only for advanced and skillful users. RA after dilution has been widely used for biostimulation and superficial purposes like subdermal wash or scraping (see Section 4.5). The ingredients of CaHA particle and carboxymethylcellulose (CMC) give a firmer and smoother contour sooner than PLLA before tissue growth. Stronger gels of HA, CaHA, and PLLA could be selected for the deep structuring as framework modification.

9.3.5 Individualized Considerations

Injections enhancing femininity should be considered and performed according to personal preference and local cultures. Asians are often shy about having exaggerated lips. Augmentation of Asian lips should be conservative and more focused on restoration of appropriate volume or correcting unevenness, inversion, asymmetry, or bad proportion, rather than enhancing volume and increasing pouting. Border definition, filtrum column building, eversion, and volume are often carried out for Caucasian women because of their soft tissue thickness and early laxity. Fullness and smoothness are more embraced by Asian women. Fullness and roundness of sexual dimorphic facial fat are considered as one of the female features, but they are the features of younger women. Caucasian women usually set their ideal shape a little older than do Asians.

9.4 MALES

Though male injection procedures are much less numerous than those for women, the requests of men for injections relate more to enhancing sexual dimorphic features than do those of women.

9.4.1 Morphological and Structural Features

The outward shape and contours of a man, when compared with same-age females, are a wider and square forehead, with the brow-glabella complex more protruding toward the front and more prominent brow ridges. Along with the brow ridges, orbital rims are thicker and stand out with bony shapes; the brows are thicker, sitting on the brow bone and oriented more horizontally; the distance between brow and the eye is shorter; noses are thicker and longer with stronger bony ridges with the nasal tip pointing a little lower. The ideal nasolabial angle of a man is around 90–100 degrees. The bony definitions of cheekbone, chin, and jawline are stronger, wider, and more angular; cheek fullness is present in the juvenile period and pulled flat after puberty; the entire midface and lower face growth is longer and pulls the face toward the front; and lips are wider and less full, with less eversion.

9.4.2 Key Points for Enhancement

The most important areas for masculinity enhancement include the brow ridges, cheekbones, chin, jawline, and mandibular angle. Bony shapes reflected from the ridges give male-patterned definitions. Bone resorption when males age results in the loss of bony support and further aggravates laxity-related tissue descent. Resorption of bone decreases the bony dimension and thickness that is the sexual dimorphic feature of men. That is why aging itself is a process of losing masculinity. Augmentation in these bony points not only enhances morphological male features but is also important for giving support and facial rejuvenation.

A broad and square forehead and solid glabella transition is important for masculinity and should be addressed for completeness. Nasal augmentation should be performed in combination with filler definition. Energy and sportiness is also a form of male sexual dimorphism. However, hollowness and depression in curves look tired and imply poor condition. Soft tissue volume restoration should also be undertaken to give a refreshed appearance. Fat accumulation of the lower face and neck blurs the margin of the jawline and spoils a masculine appearance. Lower face definition and dimension is extremely important for the look of a man and can be improved by fillers (**Figure 9.5**).

9.4.3 Injection Techniques for Masculinity

Injections of fillers for the augmentation of masculine shapes are intended to give definition and contours with stronger structures. The injection techniques should be those intended for the deep and bony plane. However, as for the jawline and mandibular angle, to build up a new ridge or shape mimicking the bones, the injector does not always have to adhere to the bone. Stronger fillers injected in the soft tissue plane 3D and spaced together could mimic the bony shapes better and more efficiently than when in the supraperiosteal plane. However, the results have to be long lasting in shape and texture. Some injection techniques incorporating fillers of softer texture but filled in the soft tissue to give similar contours – although showing reasonable results in static photographs – prove quite embarrassing because of their false tissue quality and progressive deformation. To create bony ridge shapes, the use of HA should be conservative and is indicated only for moderate correction (**Figure 9.6a–c**).

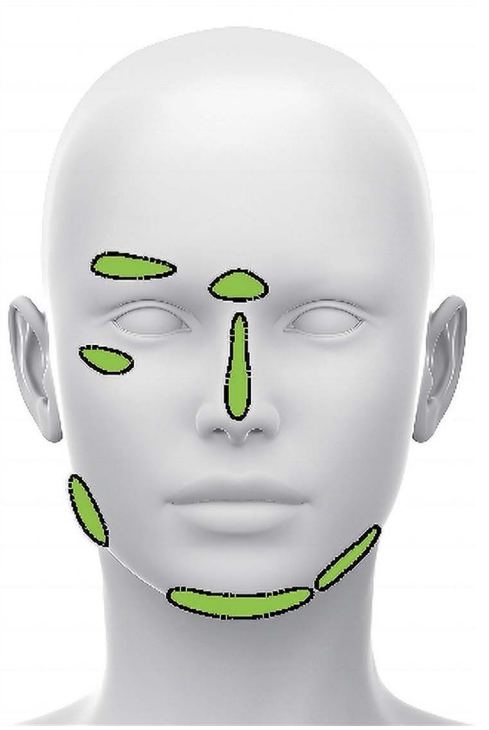

FIGURE 9.5 Injections for a man should be more focused on giving definition and sufficient dimensions. The contours created by fillers should not be too curvy or soft. The nose shape should also be adjusted to be compatible with the other ridges. Soft tissue should also be addressed for a healthier appearance.

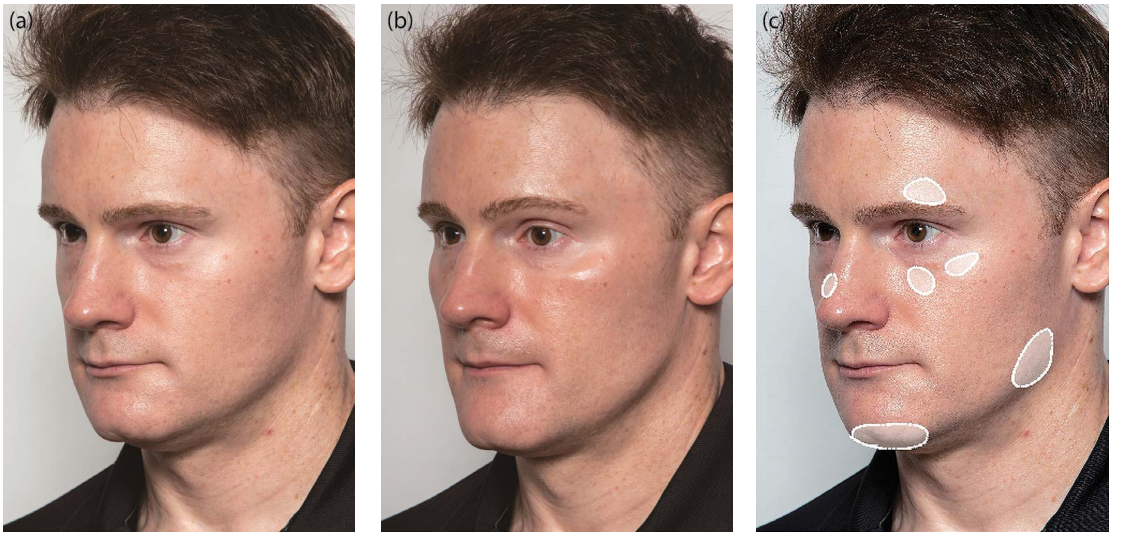

FIGURE 9.6 (a) This middle-aged Caucasian male has a relatively weak midface, asymmetric cheek, and ill-defined bony shape in the lateral brow and cheekbone. (b) Juvederm Voluma is used in this case for adjustment of asymmetry and forming ridges. Juvederm Volbella is used for the fine adjustment of unevenness of the cheek and soft tissue asymmetry. One week after injection, jawline and mandibular angle are straighter and better defined. Cheek symmetry is achieved with reasonable cheekbone prominence that is more compatible with the brow ridge.

9.4.4 Choice of Filling Substances

To give bony shapes and definitions, filler selection should emphasize rigidity and lifting capacity. CaHA usually suffices for the lifting requirement; PCL plays a similar role but is softer. HA fillers even with high cohesivity should be equipped with moderate elasticity to give shapes. Restoration of flat surface in males with less subcutaneous fat should consider using fillers of softer character. HA with swelling tendency should be avoided for males. HA filler injection should be modest in amount. The new volume provided by PLLA biostimulation is stronger in texture than fat or HA. The progressive improvement via biostimulation is less embarrassing for male patients. PLLA is a good choice for men's facial enhancement but has to be wisely and skillfully administered to mimic male-patterned curves.

9.4.5 Individualized Considerations

The preference and the presentation of male sexual dimorphism are broad in spectrum and more variable than in women. Injection for building up these shapes and protrusions should be well communicated and discussed between the injectors and patients. Although mandibular angle is one of the male facial traits and angular face creation is popular in the West, it is not well embraced by East Asian males because of the trade-off between angular enhancement and facial widening. For millennial and East Asian males, the targeting age for an ideal male shape could be set a little younger (**Figure 9.7a** and **b**). It is always an art to balance between masculine roughness and juvenile fullness, especially for men.

FIGURE 9.7 (a) This young male has temporal ridges that are prominent but asymmetrical. Volume deficiency in the temples and medial cheek is acceptable but could be adjusted for a more balanced relation among compartmental volumes showing a healthier condition and better proportion. (b) Two sections of PLLA injection were undertaken on the temples, brow, cheekbones, and cheek fat for differential touches on both sides and deep changes.

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10 Adapting Injection Techniques to Different Age Groups

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Contents

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10.1 INTRODUCTION

Injectable fillers are frequently marketed as rejuvenating agents. Fillers, as illustrated in this book, provide volume that could fill in an inherited deficiency (not always the loss with age) and add to normal contours for enhancement (not necessarily for flaws). Increasingly the younger generation receives fillers more for their glamour. Injectors should be well acquainted with the morphological and structural aging changes to adapt their injection to work better for different age groups.

10.2 THE DEVELOPMENTAL AND AGING PROCESS

Morphological changes of the face from childhood to adults and the changes of aging are fundamental in esthetic medicine. The related knowledge in outward shapes and underlying anatomy help injectors restore or improve the look of their patients properly. Facial aging is a multifactorial process involving all facial tissues, including bones, ligaments, muscles, fascia, fat, and skin. Photographs, X-rays, CT, MRI, 3D image study, and measurement along with cadaver dissection have explored this field more in the past decade, guiding the route more clearly toward better shapes.

10.2.1 Outward Landmarks

During the juvenile development stage, cranial bone growth increases dimensions in different directions but mostly in the vertical axis. Maxilla and mandible growth pull down the chubbiness and reveal more mature looks with the increase in the size of the paranasal sinuses in the face. Studies showed no obvious difference in outward landmark measurements between male and female children; male and female traits diverge during adolescent development. Imaging studies found that eyelid drooping and upper lip retrusion starts between the ages of 20–30. Upper lip thickness decreases with loss of fullness, starting about the age of 30. The vertical facial dimension keeps on increasing to the age of 40. Along with the laxity of tissue, downward and forward movement of the chin was found initially before the clockwise rotation of the face. Drooping and denting of facial folds, uneven facial contours, and dependent saggy curves are typical aging changes and increase with age. There is a decrease in the craniofacial size and increased craniofacial convexity about the age of 60. Blurring of bony ridges but the emergence of compartment borders can be noted concurrently, especially when there are weight gains with age.

10.2.2 Bone

Changes in the skeleton and remodeling of bone are driven by internal and external factors such as hormonal changes or mechanical stress. Calvarial volume decreases with increasing age, with a decrease in sagittal diameter but an increase in transverse diameter. This leads to lateral expansion of the skull,

which enhances the skeletonized appearance of the elderly. The facial bones provide the basis for facial soft tissues; these are attached to and suspend most of the fascial and ligamentous structures of the face. Morphological and structural changes during the process of aging ultimately affect all overlying tissue. For example, the calvaria is the most superior attachment for the skin and galea, which extends as the frontalis fascia and muscle in the upper face and as the superficial musculoaponeurotic system (SMAS) in the mid and lower face. The most superior anchoring points of these layers are the superior and inferior temporal septa and the superior, middle, and inferior frontal septa. The loss of bony support changes the horizontal septal vector toward a more diagonal (inferiorly pointing) vector, leading to inferior dislocation of the soft tissue. CT morphological studies investigated angles and widths of the midfacial skeleton and found an age-related clockwise rotation of the midfacial skeleton. Changes occur independent of gender; the first changes can already be observed between the ages of 20 and 29 years and continue thereafter. First, this leads to an increase of the vomer angle, followed by a decrease in the maxillary angle, an increase in the palate angle, and an increase of the orbital floor angle. An exception to the clockwise rotation is the pterygoid angle, which shows an age-related decrease, corresponding to anti-clockwise rotation. Overall, the changes in the viscerocranium result in a decrease of midfacial height and of anterior maxillary projection with increasing age, which reduces bony support for midfacial soft tissues enforcing soft tissue descent. In addition, the lower face experiences age-related loss of alveolar height and dentation. This reduces support of the lower face, once more alleviating descent of soft tissue such as the lips and jowls. Maxillary and mandibular growth accounts for most of the maturation of our facial appearances. It is related to mature facial shapes, profile patterns, and soft tissue fullness. The magnitude of the orbital bone and glabella development further impacts the roughness of a male face and the femininity of a female face; these are the natural process of facial development. Aging-related changes of bone can be summarized as the process of bone resorption. This process differs between individuals, genders, and ethnicities; however, a basic age-related pattern can be identified. Starting from the age of 30, the height of the midface decreases and the volume of calvaria reduces. This results in the loss of bony support for the overlying facial soft tissues, which start to descend. With increasing age, the infraorbital region descends inferolaterally and the floor of the orbit inclines, reducing the intraorbital support for the intraorbital fat pads. Various superficial facial angles change, leading to recess of the medial and lateral midface, which can substantially alter the pan-facial proportions.

10.2.3 Muscle

The aging changes of muscle include wasting, lengthening, decreased amplitude of movement, and increased muscle tone. Bone or ligament changes could also change the course of the muscle and worsen any redundancy. Surface-derived non-invasive electromyography (EMG) measurements showed that the motor unit action potential of the underlying musculature increased in the corrugator supercilii and procerus, while decreasing in the zygomaticus major muscle, with increasing age. This might be a factor contributing to the formation of prominent glabellar rhytids at higher age, as well as reducing support for facial fat compartments bordered by the zygomaticus major muscle.

10.2.4 Ligaments

Ligaments help fix soft tissue in place and provide mechanical competence as a hammock for fat. Age-related changes of facial ligaments have been postulated; however, to date, no scientific evidence has been provided. It could be hypothesized that the age-related changes of bone alter the position of the ligament (as they are attached to bone), which influences their orientation and their soft tissue connections. Sometimes it is the sustainable competence of the relative stiff structure that magnifies the laxity and descent of aging soft tissues.

10.2.5 Fat

Superficial and deep fat are separated by septa, ligaments, and muscles into different compartments. Different compartments have very different thicknesses and present with different tendencies to descend or increase in volume. Though deep fat compartments appear more stable, reduction, descent, or "appearance" deficiency could occur with aging, bony changes, and weakening of the hammock structures. Overall, the facial fat mass decreases with increasing age, causing facial fat compartments to lose volume independent of body mass index, thereby reducing facial volume and structural stability of adjacent structures, enforcing age-related inferior soft tissue displacement following gravitational effects. While the superficial fat compartments are mobile and descend during facial aging (superficial nasolabial and jowl fat compartment), the deep fat is stable in relation to the underlying bone. Inferior displacement of the nasolabial fat compartment and jowl fat compartment contributes to the formation of a prominent nasolabial sulcus, labiomandibular sulcus, and jowl deformity.

10.2.6 Skin

Morphological aging changes include thinning, loss of strength and elasticity, a rough, keratotic and dehydrated state, wrinkles, and unevenness of texture and colors.

10.3 YOUNGER PATIENTS

A youthful appearance is generally considered one factor of attractiveness. However, this does not mean younger people do not need any treatments for their looks. Inherited pitfalls in shape, asymmetry, proportion, contours, orthodontic problems, and surgical or trauma sequels are all independent of age. Millennials are the social media generation, and they know and care about how they look in images. Increasingly beautiful young customers come in for filler enhancement.

10.3.1 Features

Young patients who need filler works are usually intact and sufficient in their amount of fat, except the thin ones who want fillers to restore fullness. Injectable fillers are often used to add volume for an original average shape for enhancement with additional fullness or projection or for original sufficiency but a suboptimal shape in order to correct some flaws. These imperfections could come from the problem of bony dimension or orientation or imbalanced fat distribution. To refill something lost is to restore and mimic the original state. Photographs to back up the patient's report could be helpful as your reference. To create something new requires skills at a higher level. Balance with the entire face and fusion with the original curve are both important to keep the result natural. Dynamicity is another concern when the new volume just inserted has to move with the original "sufficient" soft tissue.

10.3.2 Common Indications

Enhancement and modification are indicated to correct the imperfections of symmetry and proportion without gender differences. For young subjects, enhancement is observed to be more focused on certain areas due to some cultural and fashion trends and the morphological reasons of dimorphic traits (**Figure 10.1a–c**).

FIGURE 10.1 Young subjects have first to be treated for the morphological problems that conflict with a youthful appearance such as hollowness, grooves, wrinkles, and unevenness. (a) Bony definition is important for young patients of either genders but in different patterns. Depressions of the cheeks had been corrected with Restylane Volyme and Refyne. (b) The photograph 2 weeks after treatment looks smoother but still manly. The jawline and mandibular angle were treated with Restylane Defyne and Lyft. Angular shape appears natural with appropriate dimensions and a transition that fits better the patient's preference. (c) Whitish zones indicate the treatment areas.

10.3.2.1 Male

The dimension of the lower third of the face is very important and augmentation is a rewarding treatment. Significant effects could be attained, including facial shape adjustment, a slimming effect, and a more mature appearance. The definition of the jawline and mandibles is important, too. A good chin pattern and projection along with a well-defined jawline look masculine. A well-defined cheekbone and brow helps to increase males, good looks. Fine touches to the forehead for a broader dimension and a straighter and firmer nose are all desired and feasible with fillers. Hollowness is not compatible with a healthy look (**Figure 10.2a–c**). Chubby fullness that looks odd and like a girl should be avoided.

10.3.2.2 Female

Midline enhancement and profile adjustment are important for young females. Eastern and Western females have very different preferences and ideal shapes. Compared with same-age males, females are more aware of the details of their preference. Enhancement should be very tailored to regional cultures. Young women care about minor signs of aging or some bulging or lines that are not related to aging and often ask for injections for removal or camouflage. Filler helps but probably in a different way from the treatment for the real aging signs. Fullness or roundness should be modest (**Figure 10.3a–c**). Forehead treatments are trendy in Asia, especially for young women.

10.3.3 Choice of Filling Substances

Young candidates should be treated with more targeted and precise enhancement. Soft products should be used with caution. Poly-L-lactic acid (PLLA) in experienced hands could be targeted and precise.

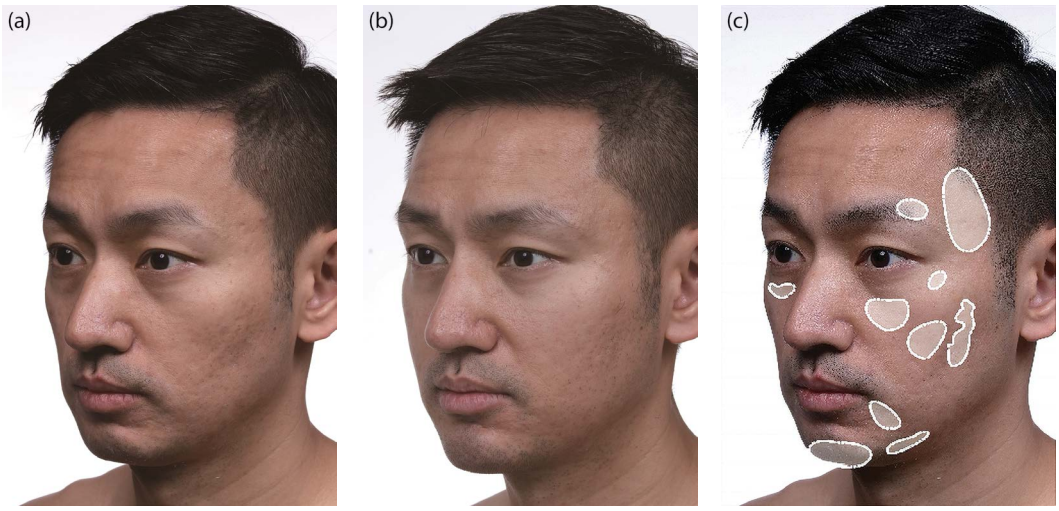

FIGURE 10.2 (a) This young male has an imbalanced fat distribution that forms gaps between compartments. An ill-defined jawline and the weak skin further worsen the problem presenting as sagginess. (b) Restylane Defyne was used to provide support on the brow, cheekbone, and jaw. Restylane Volyme was used to fill the gaps. The photograph 2 weeks after injection shows juvenile fullness compatible with his original fat storage pattern. The bony shape is defined softly, coherent with the other original ridges. (c) White marks indicate the treated areas.

10.3.4 Injection Techniques

Needles are preferable, giving pointed projection or elevation. This results from the fact that the product redistributes along the created injection canal that is most commonly perpendicular to the skin surface. A cannula could be used for linear definition. Fullness restoration should be minimal and detailed with a cannula with more passages.

FIGURE 10.3 (a) This young female has full cheeks but that fullness is set a little low in position. The cheeks and jaws are a little wide; the lower face is proportionally a little short. (b) Radiesse is used for the correction by adding volume in the chin and medial cheek to change the relation of lower face and cheek. Facial proportion and shape become better 3 weeks after injection, in a seamless process. (c) The white circles spot the filler works.

10.3.5 Cautions

Younger skin is firmer and could hide more errors or unevenness. However, overfilling is more disastrous and embarrassing for younger patients.

10.4 MIDDLE-AGED

Because this age group is experiencing the initial commencement of signs of aging, more attempts at treatment are made, when compared with the elder subjects. Because of their better tissue strength and integrity, fillers probably could achieve more as a volumizer being held by the fascia and skin.

10.4.1 Features

Patients of this group are at a stage of their lives usually characterized by full social performance. That makes treatments more affordable and the patients feel compelled to maintain themselves well.

10.4.2 Common Indications

Aging changes are getting apparent. Enhancement and rejuvenation are equally important and focused on by this group of patients, albeit they often request them in the name of antiaging.

10.4.2.1 Male

For males of this age group, most patients who come for injectable treatment aim the look compatible with their professions. Early signs of aging can give negative impressions of tiredness, sadness, malnourished, anger, or unhappiness (**Figure 10.4a–c**). The restoration of volume restores a look full of energy. Augmentation of the jawline builds up the look with more capability. Compared with females of this age, males express more indifference to the problem of wrinkles.

10.4.2.2 Female

Compared with same-age males, women of this group care about being aged. Early signs of aging, including wrinkles and lines, are more emphasized when they consult about treatments. Maintenance of their appearance is also considered important for their work and relationships. The tear trough, nasolabial fold, and periorbital and perioral lines convey the appearance of getting old and being tired. The lip volume/curve and cheek volume/curve have the same significance for women in the Western and Eastern worlds (**Figure 10.5a–c**).

10.4.3 Choice of Filling Substances

The choice of filler here is not very different from the choice for younger patients but biostimulation has some merits for this group of patients as they care more about volume loss. Collagen and elastin induction can be helpful for the initial symptoms of tissue laxity.

10.4.4 Injection Techniques

All different injecting techniques should be provided for this main sector of patients.

FIGURE 10.4 (a) This middle-aged male has an old-appearing forehead, tired orbits, wide cheeks, and mismatched lower cheek volume deficiency. The nasolabial fold is not deep but has a senile pattern. The sudden narrowing of the lower face is not compatible with his physics and body weight. Radiesse is used in this case to create a full and square forehead by the saline dissection technique. The chin shape is also modified with Radiesse. Belotero Intense is used to soften the transition of bony prominences. Belotero Balance is used for correction of the lines and unevenness. (b) Two weeks after treatment, the patient looks more refreshed and better proportioned. (c) The areas of treatment are indicated by the white zones.

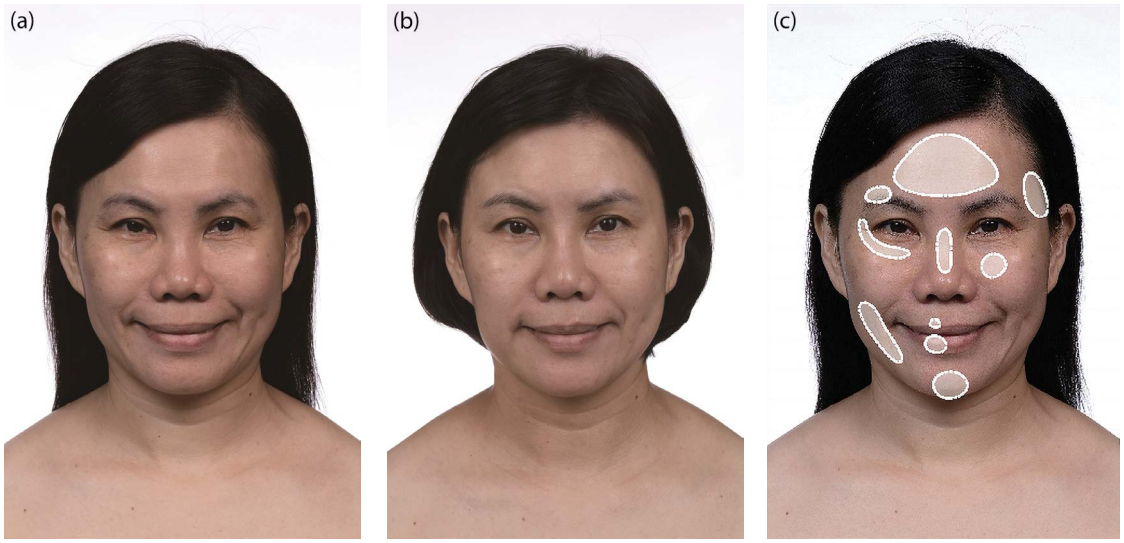

FIGURE 10.5 (a) This middle-aged woman has initial signs of aging around the eyes and less feminine bony framework that needs filler adjustment. Wide and high cheekbones can be camouflaged with volume put above, medially, and below. The nose and medial cheek need to be augmented to have more projection. The forehead needs to be addressed to be compatible with the treatment for the cheeks. (b) Restylane Defyne is used for creating cheek, forehead, and nasal projection; Restylane Volyme is used for temples to reverse the ratio. Wrinkles are touched with toxin. The dynamic curves did not look artificial. The cheek format is corrected well. (c) The areas for treatment are indicated by the white zones.

10.4.5 Cautions

Treatment should be individualized but kept natural. Patients with early signs of aging often request and are treated solely for those signs but it is better they be addressed holistically.

10.5 ELDERLY

Signs of aging are revealed more completely and prominently with age. Chronological aging and photoaging could all onset and proceed differently between individuals. At this point, framework deformation, tissue laxity, and volume discrepancy all demonstrate to their fullest extent compared with the other demographic groups. However, that does not mean fillers could or have to do the utmost for these subjects. Filling can have only limited impacts on every facet of aging, even in the scenario of aging-related volume loss. Laxity could turn a sufficient injection into an odd appearance. A comprehensive treatment of injection could be socially inappropriate.

10.5.1 Features

The fundamental bony frame resorption results in an aged appearance. Laxity and redundancy of tissue descend more with weaker support from the bony bases. The array of soft tissue compartmented by denser myofibers tissue appears as cascades, gravity-dependence, and interrupted curves (**Figure 10.6**). Surface changes of the skin due to deterioration in quality are widely disseminated but accentuated more around apertures.

FIGURE 10.6 Though shadows are prominent and easily interpreted as deficiency in volume, the apparent grooves of a saggy face are not entirely due to deficiency. Relatively fixed structures stop the descent of tissues and appear relatively less but not deficient under gravity. Filler injectors should be cautious and ensure they do not just chase the lines and shadows but address the reasons behind them.

10.5.2 Common Indications

The nasolabial fold is one of the aging signs most focused on and injection to remove it is one of the most requested treatments in the elder groups. However, injection along these grooves does not answer its pathognomonic reason. There is no volume loss in the soft tissue layers to account for this denting. That shows that many effective injections to correct signs of aging are just camouflage.

10.5.2.1 Male

As men have more of their appearance attributed to bony structure – and many elements of what is considered male sexually dimorphic traits can be attributed to the bone – resorption of the bone in the aging process has more effect in males than in females. Filler augmentation of the points of bone loss gives definition and provides support for the soft tissue. Laxity of the tissue and descent of landmarks magnify the loss of volume and broadens the space for fillers. With injectable fillers, most poor results occur here for older male patients. The aging of males is morphologically loss of masculinity, further aggravated by feminizing inflation (**Figure 10.7a–c**).

10.5.2.2 Female

Smoothness, roundness, and elegant curves reflect soft tissue abundance and are female traits. Loss of volume or descent-related contour gaps are the opposite and more important in females than males. Contour lines develop because of the changes and movements of bigger volumes of fat and muscles. Wrinkles and fine lines occur superficially and can be treated by injection as well. Focal projection or fullness for hints of femininity can be a wise touch but should be modest for women in this age group.

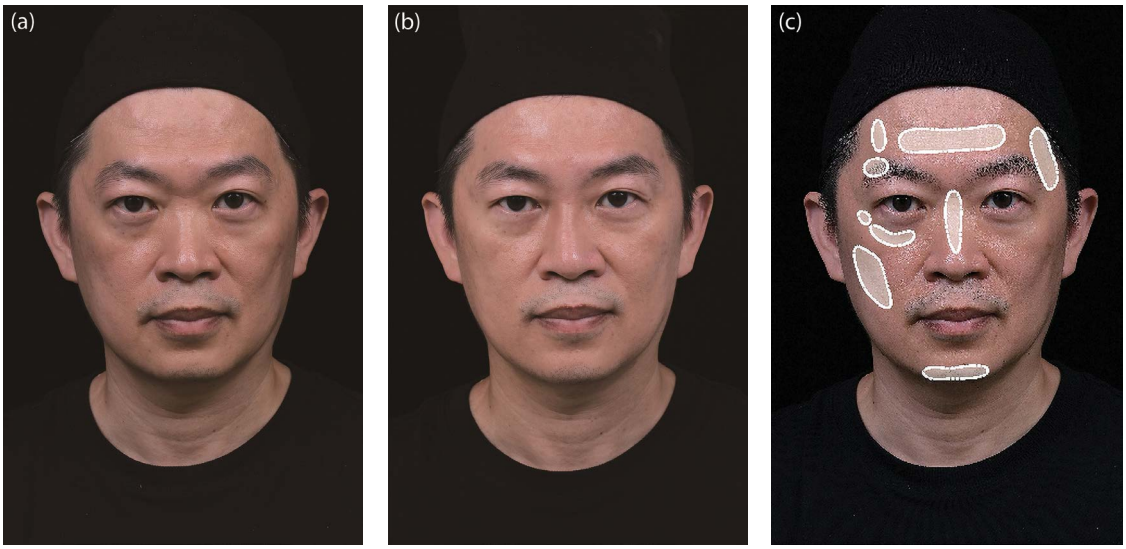

FIGURE 10.7 (a) This aged male shows a well-preserved dimension of the cheekbone but the cheekbone prominence is set lower. The narrow brows and forehead and deep paranasal fossa all need deep support. Grooves showing on the forehead and cheek look aged. (b) Sculptra is used in this case for two sections filling the gaps and deficiency in soft tissue, providing support and the shape of the ridges, and reversing the ratio by treatment on the upper face. The nose is augmented with Restylane Lyft. Three months after, the photograph shows initial but prominent changes increasing masculinity, decreasing discrepancy, and improved tissue quality. (c) The treatment zones are indicated by the white zones.

10.5.3 Choice of Filling Substances

Fillers to give supports and lift sagging tissues must be strong enough. In slim elder patients, cohesive gels could give more low-key support than CaHA. However, many people gain weight with age. In heavy sagging faces, fillers without enough lifting capacity could collapse and mix with sagging volumes. Volume loss in elder patients needs to be refilled with fillers – ideally, one with good tissue integrating capacity. However, these malleable products are less targeted in distribution and could increase the burden and further intensify a baggy deformity.

10.5.4 Injection Techniques

Deep injection techniques are useful for most aging problems and give better support and more fixed existence. Superficial multiple placements of mini droplets could stretch out redundant loose skin and improve laxity. Multilayer injection is preferred when the deficiency is large and problems are more severe. Injections across boundaries could play roles of tenting and help to merge compartments.

10.5.5 Cautions

Fillers cannot address the problem of laxity thoroughly and should not promise too much for morphological aging problems. Graceful aging is not equal to irrational juvenile curves.

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11A Adapting Injection Techniques to Patients of Different Ethnicity

Yates Yen-Yu Chao, Zeenit Sheikh, and Chytra V. Anand

Contents

INTRODUCTION

Injection demands vary in different areas and the techniques of injection – although preferred variously by different practitioners – are observed to be more similar in one region as opposed to another. The explanation is that injectable procedures are part of a culture that includes the standards of beauty, what the group is interested in and persuaded about, and how a group of practitioners understands and believes in the esthetics and mechanism behind them. Although the world has become more like a global village and people from different ethnic backgrounds move to and fro and are distributed everywhere, cultural dominance can still be observed in a specific locality pertaining to the majority of the population, although it may change over time in response to internal and external factors. Additionally, in terms of structure, people of different races have a differing anatomical framework and a differing morphological pattern. The so-called culture synchronization describes how economic power impacts on a global

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standard of beauty via the fashion and media industries; injections, however, need to be individualized and adapted to structural factors, personal factors, and local culture.

11.A WESTERN AND EASTERN PEOPLES

Yates Yen-Yu Chao

"Caucasian" and "Asian" are often the terms used professionally to peoples of the Western world and the Eastern. However, the meaning of the two words can be blurred and unequal to the real context of their geographic or anthropological definitions.

11.A.1 Historical and Anthropological Backgrounds

"Caucasian" – colloquially and according to the US Census Bureau – is a synonym of "white". The usage of "white" in reference to the European population can be traced to the 17th century. The Caucasus Mountains are located between Europe and Asia. "Caucasoid" historically means a grouping of peoples from Europe, Western Asia, Central Asia, South Asia, and North Africa. In biological anthropology, "Caucasoid" means more a phenotype focusing on their similar skeletal anatomy. The complexion can range from white to dark brown.

"Hispanic" and "Latino" are terms often used interchangeably and by the US Census Bureau. "Hispanic" refers to people born in a country conquered by Spaniards and for whom Spanish is the primary language, whereas "Latino" is more inclusive, referring to anyone of Latin American origin or ancestry.

Classification based on ethnicity should be separated from race. Ethnicity is associated more with culture, and race is more with biology. Hispanics and Latinos could have different racial backgrounds of white, black, or Native American.

"Asian" by definition means an abundance of ethnic groups in Asia with their ancestry mainly from greater Southwest Asia origin and Mongolia–China. In many areas, including the United Kingdom, the term "Asian" refers more commonly to people of South Asian origin. "Asian" is an imprecise term describing a geographic-based classification – but the span of Asia is quite wide and inclusive. The various Asian people – ranging from the Arctic to tropical rainforest – come in diversified forms and only limited biological/appearance resemblance. In esthetic medicine, "Asian" usually refers to the peoples of East and Southeast Asia or those with a Mongoloid background, whereas Southwest Asia is more commonly designated as "Hindu" and the West as "Middle Eastern".

Categorization based on ethnicity can help make treatment discussions more coherent.

11.A.2 Physical Characteristics

Three-dimensional anthropometric surveys on the comparison of Chinese and Caucasians have found that Chinese skulls are rounder with a flatter back and front (**Figure 11.A.1a–c**). A similar comparison also found that Chinese women have wider and larger faces and a broader maxillary zone. The subcutaneous tissue of the Asian patient is thicker both in body and in face from childhood to adult and increases more with increase of BMI. Accumulation of fat further blurs the face and neck junction of Asians, who have less strong mandibles.

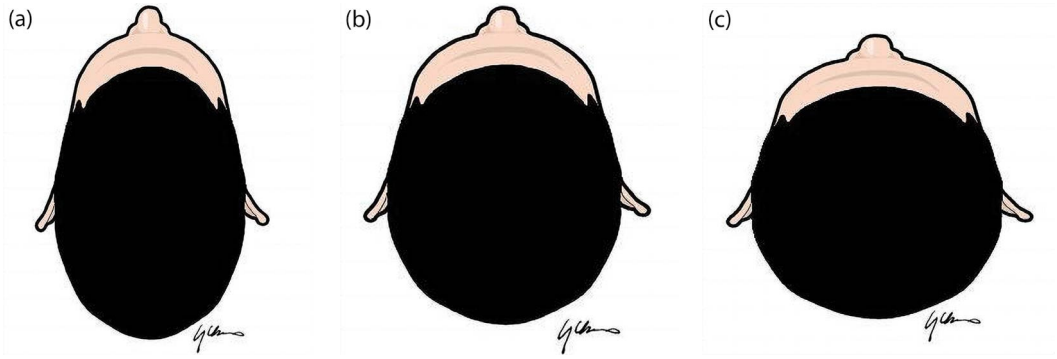

FIGURE 11.A.1 Craniometric studies have documented the racial variations of the human skull. (a) The Caucasoid skull is characterized as high dolichocephalic with a receded zygoma; (b) the median point for skull reference; (c) the Mongoloid skull is usually medium brachycephalic with a projecting zygoma.

The configuration of the skull along with the subcutaneous distribution and thicker skin explains well the difference of facial features between Mongoloid and Caucasoid. The skull shape is associated with skull development, which is partially genetic and somewhat related to ritual baby-raising habits (especially the sleeping position). Positional occipital plagiocephaly is observed to be relatively common in the generations of baby boomer and before in Asians but much less so in Generation X or after.

The flat frontal structure of a face endows lateral development. Wider intercanthal distance, wider cheekbone, wider nasal base, more flared alae, more horizontally oriented nostrils, and less defined nasal tip can be found more commonly in faces of flat, round, or square configuration.

The typical aging pattern also contrasts between Asians and Caucasians. Genetic reasons have been described for the thicker dermis and higher collagen content of Asians. Morphological and structure factors also play roles in explaining this discrepancy. Abundance in the fat component of the Asian face retains a configuration similar to baby chubbiness. A curved lower face skeleton mimics more the roundness of children. Lateral development and the shorter longitudinal dimension of the face deviate from the prolonging tendency of the facial maturating process. The wide and more laterally developed forehead, brow, and cheekbone bolster and hang the anterior soft tissue better (**Figure 11.A.2a**), whereas the narrow configuration of the Caucasoid skull loses span more prominently upon bone resorption (**Figure 11.A.3a**). White skin has less protection from UV radiation. Loose and thin skin is more apt to descend under gravity and crumple upon sheering and squeezing forces.

In general, the preference for ideal facial shape of patients from the West and the East is similar but the details of their ideal facial features are slightly different (**Figures 11.A.4–11.A.7**). Though the principle of balance and harmony is true in beauty for everybody, the format has to adapt to different starting raw materials that have been coded by the genes. The standards of beauty can mutate dynamically with cultures and trends. The injector's fine touches should respect individual conditions as well.

11.A.3 Preference, Requirements, and Indications

Studies on attractive facial shape across cultures reveal a common preference for an oval-shaped face. However, the height:width ratio of the ideal faces of Caucasians is a little higher than for Asians.

The preferences for appearance details are individualized but more similar within one ethnicity. Global and local culture all prompt the evolving of the standard and the ideal.

Indications are guided by the preference of the public and are also related to basic structures in the requirement. Injection procedures for Caucasians are mainly targeted on antiaging, focusing more on soft tissue changes (**Figure 11.A.3b**) and administrated for more mature patients, while Asians start their injections earlier and focus equally on enhancement (**Figure 11.A.2b**).

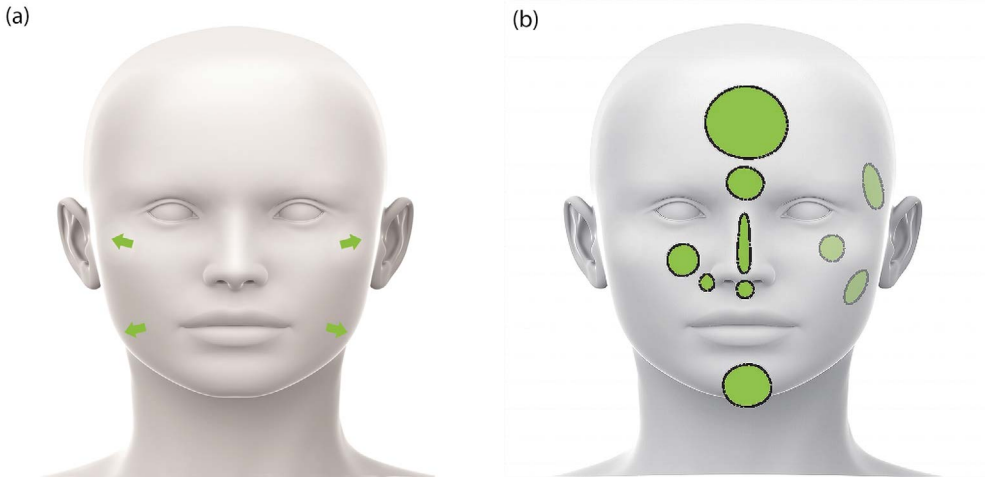

FIGURE 11.A.2 The configuration of skull impacts on the relationship between the bone and the soft tissue and the pattern of aging changes. (a) Short brachycephalic faces have a wide dimension and projecting zygoma on which to hang the soft tissue. The wide mandible and masseter stretch the soft tissue as well. (b) Adjustment from this extreme adds to the height of faces by medium augmentation and camouflage of the lateral prominence.

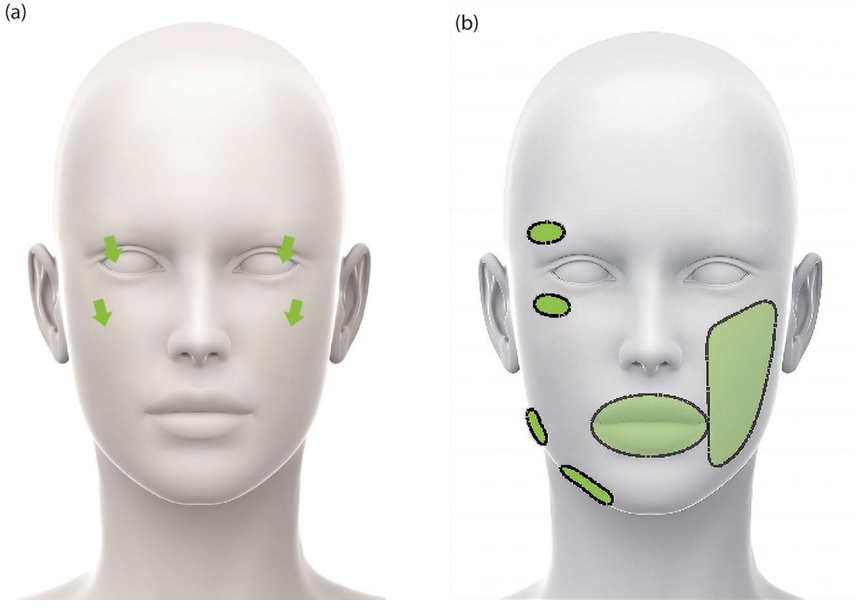

FIGURE 11.A.3 (a) Dolichocephalic faces with receded zygoma lose the structural span readily upon aging, although they usually have more prominent supraorbital ridges. (b) Adjustment from this end of the spectrum adds dimension and boost on the supporting structures. The thinner and fair skin that is more vulnerable to photodamage and chronologic aging should also treated against laxity.

FIGURE 11.A.4 The thickness of skin and subcutaneous fat is usual among Asians (a), and the wrinkling and sagging are usually more prominent in comparable aged Caucasians (b) partly due to the loss of bony span. Obesity often complicates the sagging further by increasing the burden. Soft tissue aging can be most notable around the eye and the mouth and more severe for the Caucasian.

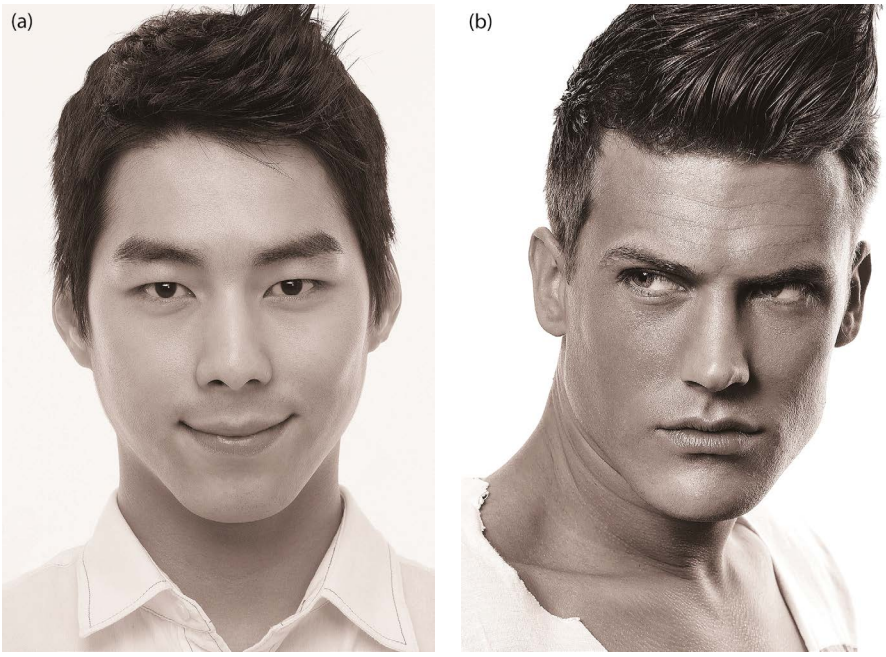

FIGURE 11.A.5 (a) The difference in the thickness of skin and fat amount is apparent since youth. The wide dimension contrasting with the short of facial height can be less prominent when cheek fullness is still sufficient. (b) Bony structure differences are more prominent in the young stage without the masking of sagging and fat accumulation. Cheek fullness exists in a different pattern and maintains its position before the loss of soft tissue elasticity.

FIGURE 11.A.6 Aged Asian female faces usually have well-preserved soft tissue thickness (a) and relatively high subcutaneous fat content. Bony ridges are less prominent in female faces and the senile changes of the bone are less prominent. (b) Soft tissue weakening is prominent in Caucasians, especially in the mobile regions. The changes present largely as wrinkles and redundancy.

FIGURE 11.A.7 Fullness is presented in different patterns for the young female of (a) Asian and of (b) Caucasian ethnicity. The fullness in Caucasians is more the shape of soft tissue with preserved juvenile chubbiness, whereas the fullness in Asians is mainly the smoothness in transition with more prominent frame shapes.

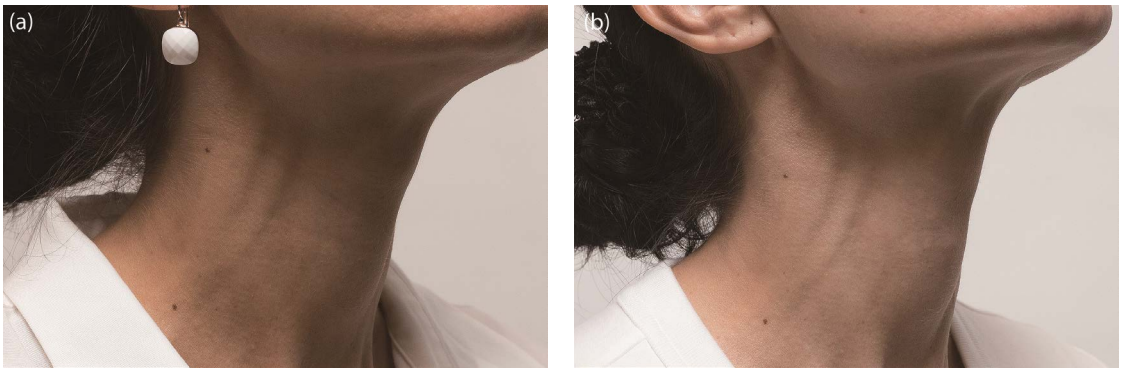

FIGURE 11.A.8 Soft tissue aging can be noted earlier and is more prominent in Caucasians. Neck skin laxity and necklines both can be observed in this Caucasian woman. Diluted Radiesse (1:1) is used for both via cannula scrapping and needle threading, respectively. (a) Caucasian skin is usually thinner and the dilution can be thinned to one portion of Radiesse to two portions of lidocaine to avoid visible accumulation below the skin. (b) The picture 2 weeks after shows good improvement without visible accumulation.

11.A.3.1 Female

The narrow Caucasian skull has a lesser span. When laxity of the skin appears and facial volume starts to decrease, sagginess occurs more easily and prominent. Augmentation of the orbital rim and cheekbone is important to reinforce the supporting system of Caucasian faces, equally in men and women. The thin skin and soft quality of Caucasians are prone to form wrinkles and become loose (**Figure 11.A.8a** and **b**). Wrinkle treatment is the major purpose of injectable fillers and toxins in Caucasians. Lip augmentation is very popular for Caucasian females. A clear jawline is generally preferred but an angular mandible is trendier in certain areas, although it does not conform to standard feminine features. The narrow and projective format of the Caucasian skull usually has less of a problem of forehead convexity and the forehead problem is less emphasized. For the aging symptoms of the Caucasian forehead, the traditional cannula technique with HA fillers is already sufficient but the technique with saline hydrodissection could protect further the intactness of the frontal vasculature (**Figure 11.A.9a** and **b**). Gluteal beauty is much emphasized in Latin America both in volume and in surface intactness. Cellulite occurs more in Caucasians and is treated more often than Asians, not only in Latin America. Soft skin and early aging is a generalized problem, occurring also on the arms, legs, and décolletage. That is why biostimulation skin enhancement is popular in the Western world.

Compared with Caucasian women, Asian women start injectable treatments earlier, even though their aging symptoms onset later. Neoteny is observed in many mid-aged Asian women without treatments. That explains why a juvenile appearance may embarrass Caucasian females but is not strange for middle-aged Asian women. The attitude toward injectable treatments is open, especially in Eastern Asia. Peer pressure and encouragement reinforce the motivation to keep oneself young and looking good. Esthetic works in a nonaging subject are simply directed to enhancement rather than antiaging (**Figure 11.A.10a** and **b**). The wide structure of the Asian skull pulls and holds the soft tissue but leaves the front of the face flat. Flatness of the face should be enhanced by midface augmentation, including the nose, medial cheek, paranasal, glabella, and the forehead. The midline of the face should be aligned and balanced when injection augmentation is planned. Premaxillary cheek augmentation that corrects the suboptimal cheek fullness and camouflages the problem of prominent cheek, when it is not accompanied by comparable nasal augmentation, further worsens the nose's sinking into the face. Wide cheekbones could be camouflaged by injection treatment on the medial cheek, submalar area, and the temples.

Chin augmentation is also a requisite for the Asian profile. It corrects additionally the height-width proportion and the facial shape. Connection to the jawline is important when the chin is to be altered further.

FIGURE 11.A.9 (a) The wrinkles and flat forehead of this elderly woman are treated with 1.5 ml of Radiesse with 1:1 dilution by lidocaine. (b) Saline hydrodissection is carried out before the infusion of filler mixture for the entire forehead to ensure thorough dissection and vessel protection. The curve of the forehead profile continues with the nasal elevation and elevates the eyelid.

Asian women are usually more careful about sun protection, and they have the protection of pigment. Thickness of the skin and well-preserved skin quality exempt most from the need for biostimulation, especially with body skin. Poly-L-lactic acid (PLLA) in Asians is indicated for shape and contour rather than for skin enhancement. Roundness and smoothness of the face are pursued in a different pattern compared to their Caucasian counterpart. Forehead works for Asians have become a trend and are important indeed for the profile and the entire facial harmony. The requirement in the Asian forehead is more for shape, since common techniques for fullness leave it looking insufficient.

FIGURE 11.A.10 (a) This young Asian female with good cheek fullness, an oval facial shape, balanced proportion, and good structural projection requested enhancement. That is a frequent situation in Asia, with patients presenting without major problems but wanting an even better appearance. (b) Restylane Lyft is selected to increase further the nasal height and projection. The same filler is also used on the chin and medial cheek to draw the apex near and define the tip. Restylane Kysse is used to treat the perioral grooves and enhance lip including the lip tubercles. The shape was maintained well 2 months after injection.

11.A.3.2 Male

The need for bone augmentation in a narrow configuration is more crucial for men. Brow, cheekbone, and mandible are all structures to give support and hold the soft tissue. Augmentation in these areas also benefits in increasing masculinity (**Figure 11.A.11a** and **b**). For masculine roughness, chin, nose, and jawline should be addressed as well.

A sunken appearance should be corrected if it comes too severe as a healthy and energetic appearance is also part of masculinity (**Figure 11.A.12a** and **b**). However, volume restoration for males should be modest and precise in amount.

The standard of attractiveness of males in Asia perhaps differs more than that of the female when compared with Caucasian. The hereditary cultures favoring a pen more than a sword could approximately explain that a gentle, refined temperament is more admired than roughness. The wide skull of Asian men has to be addressed more on the midline. Chin and nose jobs are the most indicated areas. An over-wide cheekbone could be softened by some injection nearby. Conversely, a wide jaw should be modulated with toxin. The problem of a short skull, thick subcutaneous layer, and weak lower face often presents with a blurred cheek-neck junction. This problem often gets worse with weight gain and soft tissue descent. Jawline building and mandibular angle development can be easily achieved with injectable fillers.

Millennials and the younger generation have their own perspective on attractiveness, both in the Western and the Eastern world. Old-school masculinity is not embraced as much as before. Beard growth has become popular. Delayed life milestones also change the way these patients look at themselves. Many of them start filler treatments earlier. All these factors require more diversified approaches.

FIGURE 11.A.11 (a) Sculptra treatment is used for the young Asian man to restore facial volume and correct the original upper facial contour and dimension. (b) Lower face and cheekbone definition is also accomplished with Sculptra injection. One year after three sections of treatment all these problems had good and natural improvement.

FIGURE 11.A.12 Smoothness and reasonable fullness is equally important in young patients of different racial groups. (a) Before treatment (b) after HA filler treatment.

11.A.4 Filler Selection and Injection Techniques

Fillers under thin skin are more easily detectable. The amount of filler could be less but distribution has to be even. For the purpose of layering, a cannula could be adopted for more passages and better control in the same layer. Asians often have thicker skin that could cover more faults and unevenness. However, fillers in minimal amount or with a soft character could hardly achieve visible effects or modify contours (**Figure 11.A.13**). Targeted filler presence is more required in Asians than is layered distribution. The multilayer approach by

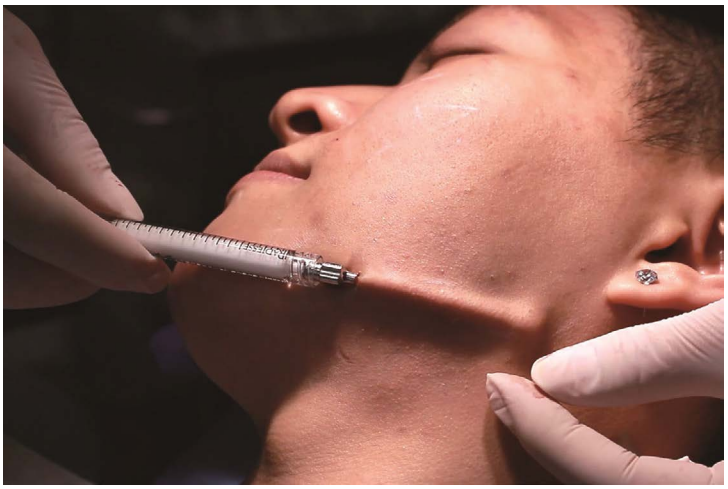

FIGURE 11.A.13 A surgical cannula is adopted here for injection of Radiesse to build up a masculine mandibular angle.

needles and cannulas is different in the manner of application and of filler distribution. Needles should be considered more for Asian subjects to increase the precision and the efficacy of injection.

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11B Adapting Injection Techniques to Patients of Different Ethnicity

Yates Yen-Yu Chao, Zeenit Sheikh, and Chytra V. Anand

Contents

11.B BLACK/AFRICAN ETHNICITY

Zeenit Sheikh

Africa is not only rich with a diverse plethora of many cultures, but being a center of the world trade route, it is also influenced by Eastern and Western philosophies, ultimately creating a unique and constantly evolving ideal of attractiveness and beauty.

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11.B.1 Historical and Anthropological Background

The evolutionary biologist J.B.S. Haldane posed the following question to anthropologists in 1956: "Are the biological differences between human groups comparable with those between groups of domestic animals such as greyhounds and bulldogs?" This analogy, both provocative and fallacious, has flagrantly been employed to justify the propagation of social, political, and economic discrimination. There are far more similarities between "human groups" than differences. Indeed, these very subtle and nuanced differences are often key to bestowing a sense of sociocultural belonging. Within an African context, these distinctive traits are worthy of celebration.

Africa, the world's second-largest and second-most populous continent, extends over both hemispheres, spans 6 time zones, comprises over 50 countries, and is home to over a billion people. Africa's peoples demonstrate a rich diversity of physical appearance, with different facial features, body builds, and skin tones. While African Black people are typically recognized as having a darker skin tone, this color is often geographically distributed with a light tanned tone in the northern part of the continent to a very dark tone in the mid-African countries closer to the equator.

11.B.2 Physical Characteristics

Despite the skull-based categorization of 18th-century German philosopher Christoph Meiners of Black African skulls as "Negroid", describing a short dolichocephalic skull with receded zygomas and wide nasal apertures, African faces are replete with diversity. Nevertheless, some of the more defining characteristics shared by many Africans lie in the midface: thicker sebaceous nasal skin, a poorly defined nasal tip, a flatter nasal bridge, and wider nasal alae, often supported by a poor nasal septum, hypoplastic premaxilla, and nasal spine that ultimately results in an acute nasolabial angle (**Figure 11.B.1**). **Table 11.B.1** illustrates a comparison of the defined measurements between African and Caucasian subjects.

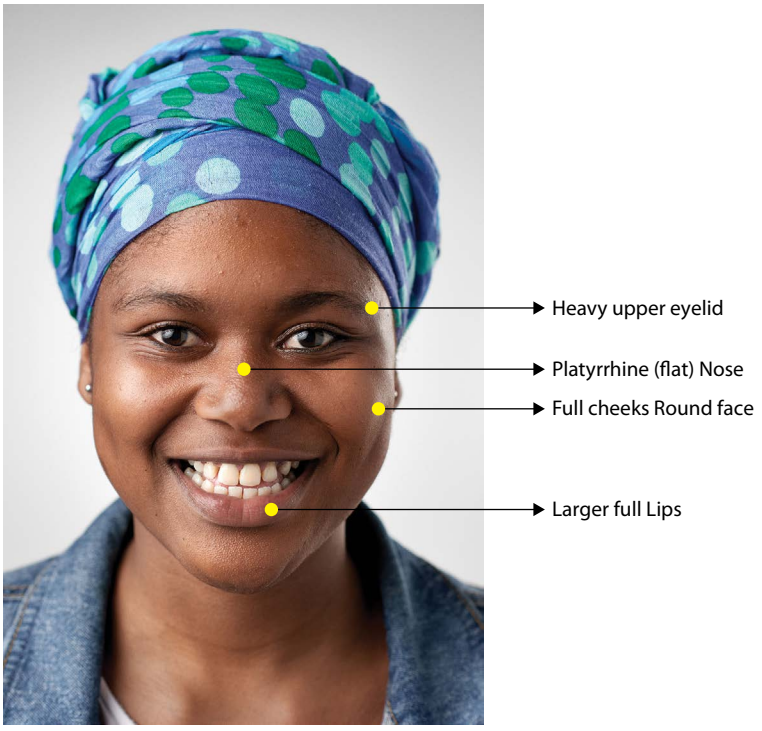

FIGURE 11.B.1 Characteristic features of the typical African patient.

TABLE 11.B.1 Midface measurements compared between African and Caucasian subjects (see further Farkas et al., 2007)

	AFRICAN	*CAUCASIAN*
Average Piriform Aperture	26–27 mm	23–24 mm
Average Interalar Width	44 mm	36 mm
Nasolabial Angle	79 ± 15°	102 ± 8°

The lips are another commanding feature of Black African people, which often appear relatively larger and more protrusive than Caucasian lips (**Figure 11.B.2** shows this comparison, applying a commonly used profile measuring tool – *Rickett's line*). This fuller, proud appearance is mainly due to an abundance of the underlying mucosa and hyperplastic minor salivary glands, which may often measure between 2 and 4 mm (Cobo, 2015).

The juxtaposition of a broader, less projected nose with large and bold lips creates a lower face dominance, contributing to the significant appearance of protrusion that accompanies a relatively accentuated chin retrusion (**Figure 11.B.3**).

There is some evidence to support the hypothesis that African craniofacial aging progresses at a slower rate compared to Caucasians (Buziashvili et al., 2019); however, this does not confer complete immunity. A proptotic orbit, age-related soft tissue volumetric loss in the midface, and maxillary and – to a lesser extent – zygomatic resorption in the African craniofacial frame leave the midface susceptible to a hollowed appearance (Mendelson and Wong, 2012).

Compared to lighter skin, the darker African skin confers a relatively greater photoprotective capacity (with an SPF rating of up to 13.4) as a result of the higher concentration and distribution of melanin

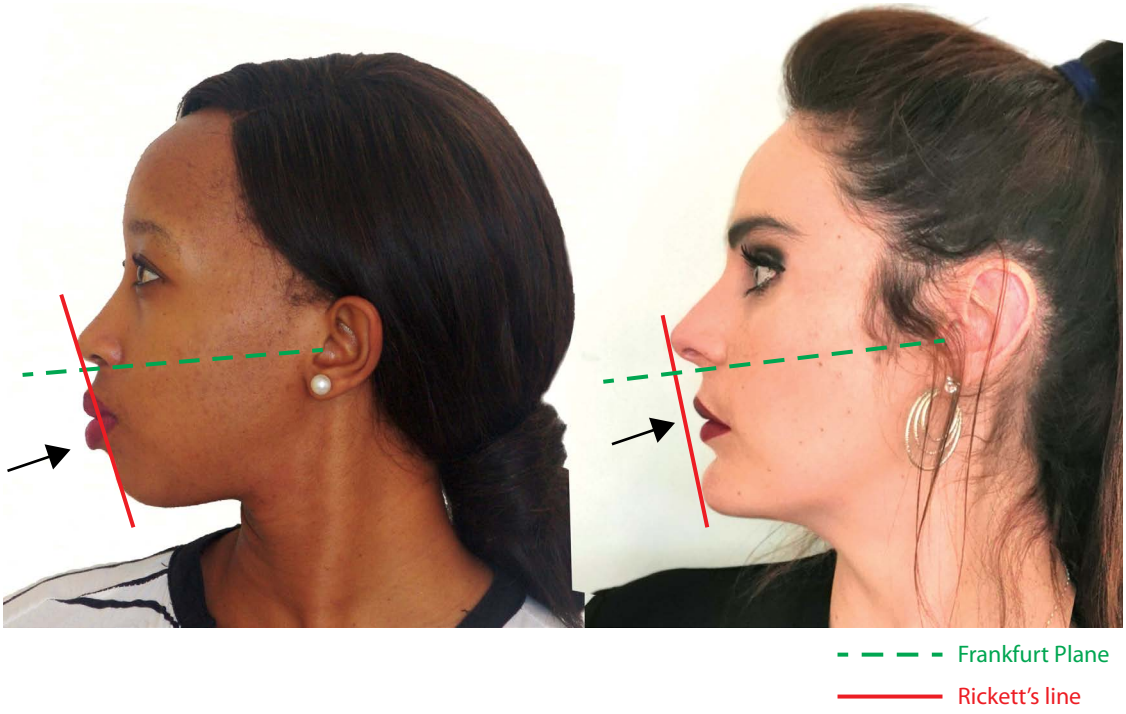

FIGURE 11.B.2 Comparison of African and Caucasian side profiles with relationship of lips to Rickett's line. (a) The left image indicates African and (b) the right image indicates Caucasian (b). Rickett's lines indicated in red. Frankfurt reference planes are in green.

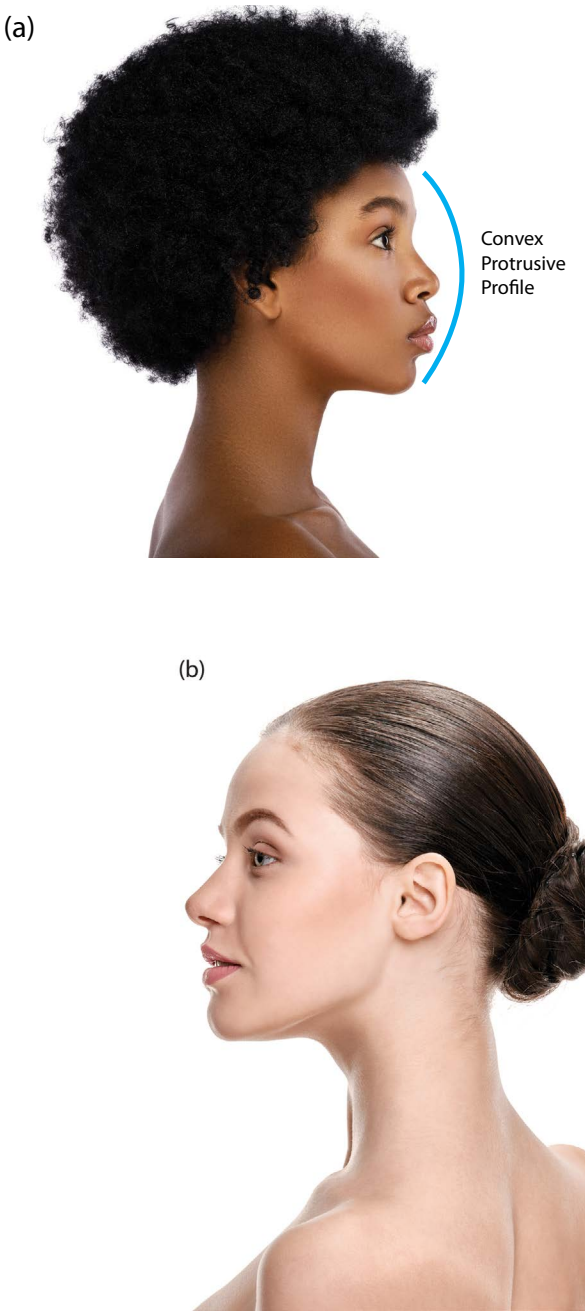

FIGURE 11.B.3 (a and b) Lateral view of the more convex African profile as compared to a Caucasian.

levels (Kaidbey et al., 1979). The stratum corneum has more cellular layers that are compacted with increased cellular adhesion (Alexis et al., 2019). Dermal fibroblasts appear larger, in greater numbers, and are more active (Nijhawan and Alexis, 2011). In part, this may explain the unique profile of delayed photoaging commonly seen in African skin, as well as the predisposition to keloid formation.

11.B.3 Preference, Requirements, and Indications

The perception of beauty from most Black African perspectives differs from Caucasian ideals. A fuller face, with prominent cheeks (rounder, not contoured), large lips, well-framed eyes (not sunken), and a healthy radiant skin, is held in high regard in most African communities (Beukes et al., 2007). In women, an overall fuller figure and fuller face are associated with health, wealth, femininity, and reproductive capacity (Tovée et al., 2006).

A straighter facial profile is generally preferred among African-Americans (Farrow et al., 1993). The motivations are complex but are at least partially due to the societal pressure exerted by the association between a higher social status and a European appearance – lighter skin tones, narrower noses, and thinner lips (Jablonski, 2011). Furthermore, many African-Americans identify themselves as multiracial.

The perception of attractiveness is largely affected by the environment and its societal influences, as can be demonstrated by the varying views of beauty and attractiveness in Africans across other continents (Coetzee et al., 2012).

11.B.3.1 Female

African women most often first present for anti-aging treatments in their 50s (much later compared to Caucasian women) to improve forehead lines or nasolabial fold correction (Alexis et al., 2019).

Dissatisfaction with nasal shape is common across all cultures, although younger African women with a distinctive platyrrhine nose tend to pursue the more projected nasal bridge with narrower alar, or an "English nose", as it is colloquially referred to by Black South African women.

African women do not often present for lip filler treatments; however, as with aging in all ethnicities, it may be necessary to restore the loss of fullness and often wrinkle formation below the vermillion border (Talakoub and Wesley, 2009).

Chins with a hyperdynamic mentalis muscle are often retruded.

11.B.3.2 Male

Much like African women, African men are somewhat protected from the more rapid aging seen in their Caucasian counterparts. Midface hollowing and less prominent malar projection with maxillary retrusion gradually advance with aging, and a particular susceptibility to chin withering with cutaneous degeneration is notable (Flament et al., 2018). The vast majority of African cultures place African men as the breadwinners in their families. Consequently, African men often present with the desire for stronger, more masculine features. Restorative approaches to protect the midfacial volumes, strengthening the mandibular border and maintaining a broad and projected chin, are indicated.

While cosmetic medicine is expanding in popularity, there are some African cultures that may regard these procedures as taboo. Special care needs to be taken, particularly in older African men, and a more subtle approach to enhancement and rejuvenation may be preferable.

11.B.4 Filler Selection and Injection Techniques

Dermal filler procedures in African patients carry the same inherent risks that are present in Caucasian and Asian patients: vascular complications, over- and under-correction, granuloma formation, Tyndall effect, bruising, and pain. In African patients, specifically, additional complications of keloid formation and post-inflammatory hyperpigmentation are often sources of concern.

Numerous peer-reviewed articles and the author's extensive experience with filler procedures in African patients suggest dermal injuries from 27-G needles or finer do not appear to be associated with any significant keloid formation risk (Alexis et al., 2019). However, serial puncture techniques have been

shown to carry the risk of pigmentary changes in African patients (Nijhawan and Alexis, 2011). While hyperpigmentation caused in this way is often transitory in nature, injection strategies should be adapted to minimize the number of injection points in African patients. In addition, topical prescription or cosmeceutical skin lightening agents may be used in patients who are at high risk.

Hyaluronic acid (HA) fillers, the most commonly used dermal fillers, as well as calcium hydroxylapatite (CaHA)-based fillers, have been shown to be safe for use in patients with skin of color (Marmur et al., 2009). There are fewer published data available for comparative analysis between different skin colors with the use of poly-L-lactic acid (PLLA), polycaprolactone (PCL), fat grafting, or stromal vascular fraction gel (SVF)-based filling; however, these are all deemed to carry no inherent additional risk.

Filler mediums may require a higher G′ with a greater lifting capacity to accommodate the often firmer and better preserved skin and soft tissues of African patients; however, filler choices should always be made on an individual assessment. See **Figure 11.B.4** for recommended filler placements in African patients.

11.B.4.1 Nose

11.B.4.1.1 Filler selection

Thicker sebaceous nasal skin requires a more robust choice of filler with good lifting capacity and little-to-no tissue integration. A high viscosity, high G′ HA filler is indicated to achieve the best lifting and shaping of the nose, with the least risk of complications. A CaHA or PCL filler may also be injected by a fully trained and suitably experienced injector.

11.B.4.1.2 Filler placement

Deep injections on the periosteum with a needle or into the deep subcutaneous layer with a 22-G 50- to 70-mm cannula and slow retrograde injection are preferred for nasal bridge projection (dorsum augmentation). African patients may require relatively larger volumes to build up a very deficient nasal bridge. Multiple

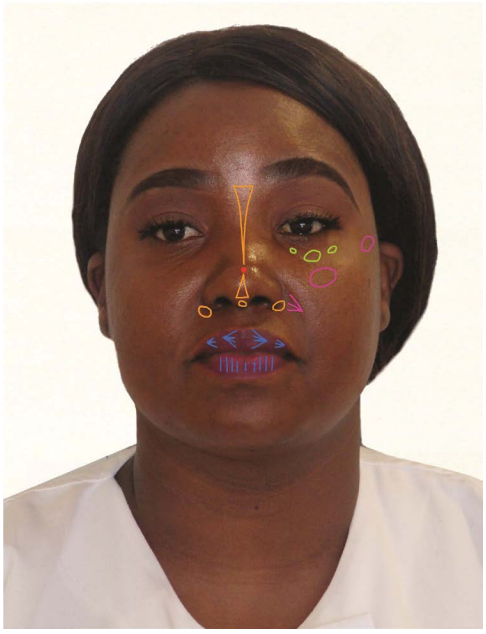

FIGURE 11.B.4 Filler placement for the African patient: orange, nose augmentation; blue, lips volume/structure restoration; pink, midface augmentation; green, infraorbital hollowing correction; red, entry point for cannula.

injection sessions may be required to prevent external compression and obstruction of the nasal vasculature. Volumes from 0.2 to 0.8 ml, usually not exceeding 1 ml, may be injected per session.

The piriform fossa may also be treated by placing deep periosteal injections with a needle directly on the bone to support the alar cartilages like a tent and thereby narrow the nostrils. Filler volumes range between 0.2 and 0.5 ml per fossa.

Nasal tip projection may be achieved by supporting the columella by placing filler at the anterior nasal spine with a 27-G needle or 25-G blunt cannula. This has the additional advantage of improving an acute nasolabial angle. The filler volume required is usually in the range of 0.2–0.4 ml.

11.B.4.2 Midface/full cheeks

11.B.4.2.1 Filler selection

Robust fillers with a high lifting capacity are often required to improve medial cheek volume loss as a result of maxillary retrusion and a mildly proptotic orbit.

11.B.4.2.2 Filler placement

For structure and support, it is best to inject deep onto the bone at the zygomaticotemporal suture line to have anterolateral lifting and on the malar eminence (the maximal projection point) to give inferior support to the orbit and indirectly improve the sub-orbital hollowing.

Use a 27-G needle down to the periosteum, with 0.5–2 ml per side.

11.B.4.3 Lips

11.B.4.3.1 Filler selection

It is recommended to use volumizing or lower molecular weight HA fillers or as indicated, depending on the skin quality and firmness of the lip body. Non-HA fillers are contraindicated.

11.B.4.3.2 Filler placement

Superficial placement of a soft viscous filler with a 29-G needle may be used to reduce rhytids of the vermillion of the lips. A total of 0.2–0.5 ml per lip is often adequate as care must be taken not to over-project or accentuate protrusion. In advanced aging of African lips, deeper placement of a more volumizing filler with a 25–27-G cannula may be required.

11.B.4.4 Tear trough

11.B.4.4.1 Filler selection

A low hygroscopic HA filler is ideal.

11.B.4.4.2 Filler placement

It is recommended to use deep injections along the orbital rim in multiple micro-boluses (0.05 ml per bolus) with a 29-G needle or 25-G cannula to support the proptotic orbit. Volumes of 0.2–0.4 ml per tear trough are usually sufficient. Furthermore, filler placement as needed may be performed after 2 weeks.

11.B.4.5 Chin

11.B.4.5.1 Filler selection

A firm, high G′ HA filler with a high lifting capacity is ideal. A CaHA or PCL filler may also be injected by a fully trained and suitably experienced injector.

11.B.4.5.2 Filler placement

Deep placement with a 27-G needle along the pogonion may often be required to create balance where excessive protrusion of the lips is present.

Botulinum toxin of the mentalis muscle may be required at least 2 weeks prior to filler treatment where hyperdynamic and hypertrophic muscle would preclude the use of sufficient filler.

Volumes of filler are variable, depending on the degree of lip protrusion and relative retrognathism on profile balancing. A total of 0.5–2 ml per session may be required.

With globalization and its complex effects on sociocultural interactions and economic implications, Africa may be losing part of its unique identity, but by balancing our patients' requests while respecting their distinctive ethnic charisma, African patients stand very much to gain.

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11C Adapting Injection Techniques to Patients of Different Ethnicity

Yates Yen-Yu Chao, Zeenit Sheikh, and Chytra V. Anand

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11.C THE INDIAN PERSPECTIVE

Indians make up one of the largest demographics in the world. Their facial morphology differs from that of other populations, which impacts age-related changes and approaches to these changes by the treating physician and the patient.

In Indians, the perception of aging is related to skin texture and pigment in their 30s, while from their 40s onward, the wrinkles, folds, and sagging were perceived to contribute to aging (Merinville et al., 2018); in other ethnic populations, wrinkles, folds, and sagging contributed to aging changes at an earlier age (Mintel, 2017a,b).

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11.C.1 Anthropometric Features in Indians

Table 11.C.1 indicates how certain anthropometric features are characteristic in an Indian population, as opposed to a Caucasian.

Due to the facial anatomical characteristics of Indian faces, their facial aging is unique. It is due to the medial descent of deep fat compartments and volume deflation, leading to sagging of thicker soft tissue on the smaller skeletal framework. This leads to a predisposition to infraorbital hollowing at an early age and the perception of sagging and drooping when patients are in their 40s (Shetty, 2014; Bernois et al., 2011).

11.C.2 Treatment Outlines for Indian Faces

Soft tissue is heavier in Indian faces at the midface area (Shetty, 2015), which leads to the bulkiness of the face, which is a primary concern for Indians, along with submental fat (Sowmya et al., 2014). The facial width of the majority of Indian women is more than the length, leading to a broader and rounder face. Moreover, compared to women of other regions (such as Caucasian women), Indian women have more soft tissue in the face, especially in the midface area.

The cultural ideal for an Indian woman is an oval face with a rounded contour, even with varying anatomy, skeletal structure, morphology, and skin texture (Liew et al., 2016; Goodman, 2015; Prasanna et al., 2013).

The top aging concerns of Indian women broadly fall into two categories: from 20 to 40 years and over 40 years (Kapoor et al., 2017; Farkas et al., 2005; Jagadish Chandra et al., 2012; Kalra et al., 2015). From 20 to 40 years, the top concerns are infraorbital hollowing and periorbital hyperpigmentation (the shadow effect), lip augmentation, facial shape, nasolabial folds, and skin radiance or hydration. The reasons for these are a retruded maxilla, loss of subcutaneous tissue, a thinner upper lip, and shorter face height.

From 40 years, their concerns tend to be nasolabial folds, jowls and jawline changes, marionette lines and lip droop, facial lines and wrinkles on the upper face, neck laxity, and skin quality changes. The reasons for these are tissue sag, the descent of deep fat compartments, mandibular retrusion, sagging of the skin due to laxity, and dynamic lines.

Today, both the advent of non-surgical modalities for a three-dimensional approach to facial rejuvenation and restoration and the specific nuances of an Indian face require a multi-dimensional approach combining various injectable modalities for a natural result. There are two basic concepts underlying the general

TABLE 11.C.1 Characteristic features of an Indian population

FEATURE	*INDIAN POPULATION*	*SPECIFIC ANATOMY*
Total face height	Smaller and shorter	*The forehead height is greater compared to the lower third face *Facial shape: less oval
Midface	Shorter and narrower	*Facial shape: more rounded
Bi-ocular width	Wider than Caucasian	*Wider eyes *Larger eyes
Lower face width	Wider than Caucasian, less than South-East Asian	*Smaller chin *Smaller lower face
Nasal length	Less than Caucasian, more than South-East Asian	*Wider nose *Shorter dorsum
Profile: convex	More than Caucasian and South-East Asian	

Sources: Shetty, 2014; Bernois et al., 2011; Shetty, 2015; Sowmya et al., 2014.

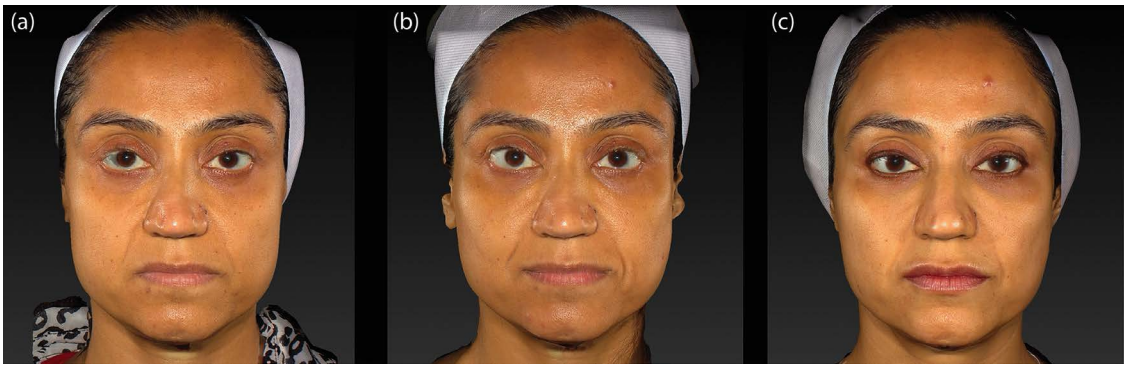

FIGURE 11.C.1 A 0-degree profile: (a) pre-, (b) post-foundation, (c) post-augmentation.

approach to the Indian face: foundation (or correction; where skeletal and structural deficits are corrected, concentrating on facial shape) and augmentation (or restoration; where soft tissue is augmented and restored).

Stepwise Approach to Injecting the Indian Face (Figures 11.C.1–11.C.3)

For what follows, see further Shetty (2015), Kapoor et al. (2017), Anand (2016), and Sharad (2020).

11.C.2.1 Foundation

11.C.2.1.1 Facial shape

In Indians, an oval shape is desired. Structurally, the total facial height is shorter, and hence the face needs to be elongated and narrowed. For this, an oval is marked around the face. Areas that are within the oval are projected, and areas that are outside the oval are debulked.

The idea is to increase the midface by malar projections in the lateral and medial cheek, increase vertical height by increasing chin length and projection, and reduce the bigonial width through masseter muscle reduction.

The cheek/malar projections are accentuated using a high-density hyaluronic acid filler on the supra periosteal plane.

Chin length is increased, and lateral projection is accentuated with a high-density hyaluronic acid filler at the supraperiosteal plane.

The bigonial width is reduced to narrow the face to fit into the oval with botulinum toxin A injection placed intramuscularly.

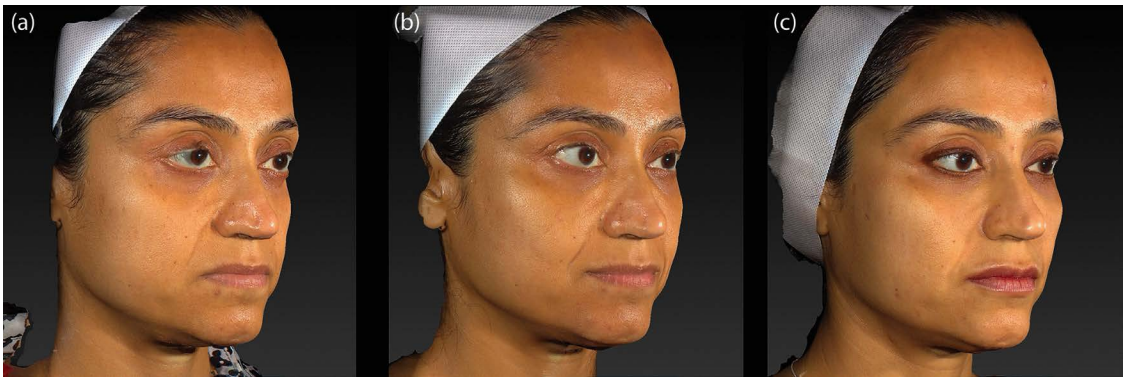

FIGURE 11.C.2 A 45-degree profile: (a) pre, (b) post-foundation, (c) post-augmentation.

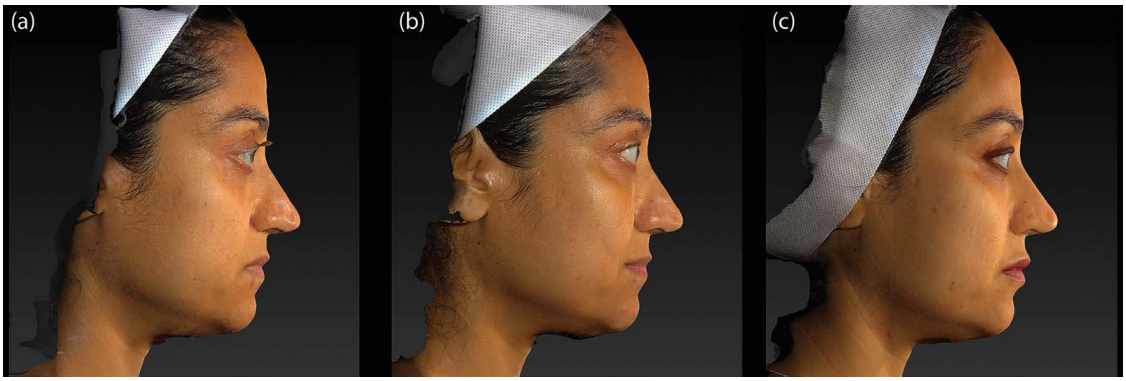

FIGURE 11.C.3 A 90-degree profile: (a) pre-, (b) post-foundation, (c) post-augmentation.

11.C.2.2 Augmentation

11.C.2.2.1 Midface

Indian faces have a weak midface structure with a retruded maxilla, which is the leading cause of infraorbital hollowness at a younger age. The retrusion also creates an appearance of soft tissue excess or bulkiness. The nose tends to be shorter and broader, leading to a flat appearance and poor light reflex.

The aim is to enhance the concavity of the face and the lateral and mid-cheek projections, treat the infraorbital hollowness, reduce the medial cheek heaviness, narrow the nasal width, and lengthen the dorsum of the nose. This would achieve a harmonious and balanced look.

The lateral cheek projection at the zygoma is enhanced with a high-density hyaluronic acid filler at the supraperiosteal plane and malar projections, and facial concavity is increased with a combination of high-density hyaluronic acid and medium-density hyaluronic acid fillers, layered supraperiosteally and subcutaneously for a natural result.

The tear trough area is filled with minimal volume with a low-density hyaluronic acid filler with low water retention.

The nasolabial folds are softened by injecting at the pyriform fossa and into the line if required using a medium-density hyaluronic acid filler.

The nasal dorsum is accentuated for light reflex, and nasal width is reduced by injecting into the pyriform fossa with a high-density hyaluronic acid filler.

11.C.2.2.2 Lower face

The lower face is broader and shorter in an Indian face. The chin retrusion and a weak mandible do not support the lower face soft tissue, leading to drooping of the lip corners, the appearance of jowls, and marionette folds. Lack of support leads to a soft tissue heaviness in the central part of the lower face.

The aim is to reduce the bigonial width of the face, lengthen and project the chin, and support and restore volume in the marionette folds, lips, and submalar region to provide a support frame for the soft tissues in this area and reduce the jowls.

Lower face width is reduced by masseter injections placed intramuscularly into the belly of the masseter using botulinum toxin A injections.

Chin length is increased, and lateral projection is accentuated with a high-density hyaluronic acid filler at the supra periosteal plane. The chin complex is injected in a subcutaneous plane with a medium-density hyaluronic acid filler. Intramuscular botulinum toxin A injections relax the mentalis muscle.

The marionette folds, jowls, and lip corners are supported by injecting a density hyaluronic acid filler in the subcutaneous plane and a high-density hyaluronic acid filler at the supraperiosteal plane for support.

The submalar area forms additional support for relieving the centro-facial bulkiness in Indian faces by injecting a medium-density hyaluronic acid filler in the subcutaneous plane.

11.C.2.2.3 Neck

Skin quality is an area of concern in Indian skin, especially on the neck leading to skin sagging and the appearance of horizontal bands. Additionally, the activity of the platysma tends to accentuate the jowls in the Indian face.

The aim is to relax the platysma bands, improve skin quality, and relax the skin tension in this area.

Steps:

- The skin is hydrated with a non-reticulated HA filler placed superficially in the neck to improve the skin hydration and quality.
- The platysma bands are relaxed to improve the jawline and relax skin by intramuscular botulinum toxin A injections.
- The horizontal bands are additionally treated with MicroTox using hyperdiluted botulinum toxin A to release the superficial skin tension.

11.C.2.3 General points

Indians prefer a natural look; they don't like to be overfilled.

The choice of an injectable filler is critical to achieving a natural look. The choice of the filler depends on the skin thickness and the existing skeletal framework: high-density HA fillers are typically used for bony projections; medium-density HA fillers for soft tissue changes and augmentation; low-density HA fillers with low water retention for under the eye; and non-cross-linked HA for skin texture.

Avoid extra volume in the midface and central zones of the face, as this leads to heaviness and further sagging.

The most noticeable aging changes are seen in the face's peripheral areas, starting at the periphery and moving to the central part of the face.

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12 Prevention and Management of Complications

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Contents

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12.1 INTRODUCTION

Upscaling of the filler injection technique is not only for achieving natural and beautiful results but also for keeping the whole process safe with as few unwanted reactions as possible.

12.2 MINOR REACTIONS

Though injectable filler treatments are generally considered safe, minor imperfections are quite common. Reactions to the normal process of instrument insertion and foreign substance placement could be considered normal but still could be reduced in extent and severity by technique refinement.

12.2.1 Normal Consequences of Injections

The process of injecting filler involves breaking the skin, instrumental penetration within a tissue, and introducing filler substances. In other words, these treatments create surface wounds, tissue trauma, and foreign body reaction.

12.2.1.1 Bleeding, ecchymosis, and bruising

Bleeding is a normal consequence after wounding. Disruption of vessels could occur at different levels with the mildest in fine capillaries. Extravasation of blood leads to bruise discoloration, swelling, pain, and residual pigmentation.

Piercing of the needle can be directed toward the area without visible superficial veins (**Figure 12.1**) under good illumination (**Figure 12.2**). There are infrared imaging devices for extracorporeal detection of underlying vessels. Very superficial injection targeting the dermal-epidermal junction can elude the vessels and often finishes bloodlessly. The portal for cannula entry should be selected carefully and undertaken with needles with understanding of the underlying vascular anatomy and appropriate needle orientation (**Figure 12.3**). Vertically oriented insertion could shorten the route (**Figure 12.4**) of needle

FIGURE 12.1 Superficial temporal vessels are often visible given sufficient illumination.

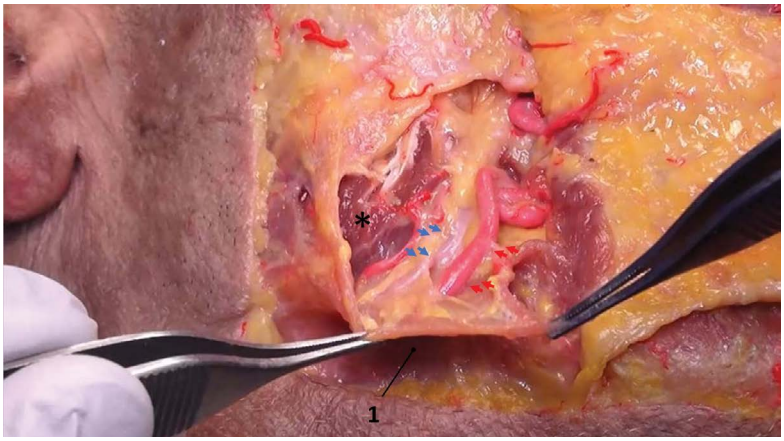

FIGURE 12.2 Cadaveric dissection of the lower face. The facial vein (blue arrows) and facial artery (red arrows) are exposed, crossing the mandible beneath the platysma (1) at the anterior border of the masseter muscle.

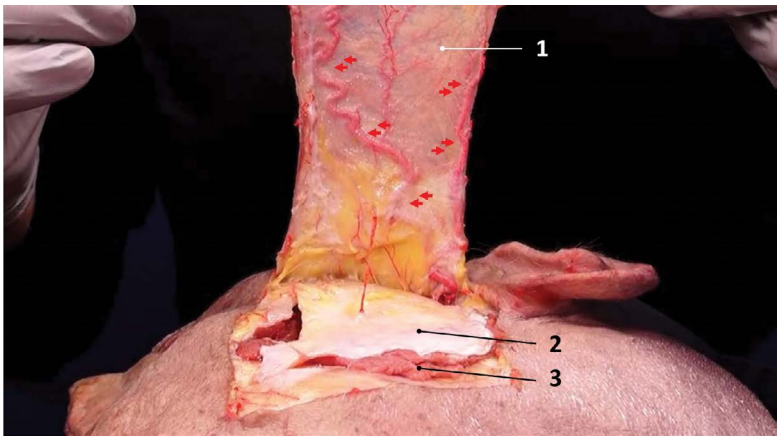

FIGURE 12.3 Cadaveric dissection of the right temporal region. The anterior and posterior branches of the superficial temporal artery course within the superficial temporal fascia (1: red arrows). The deep temporal fascia (2) covers the temporalis muscle (3).

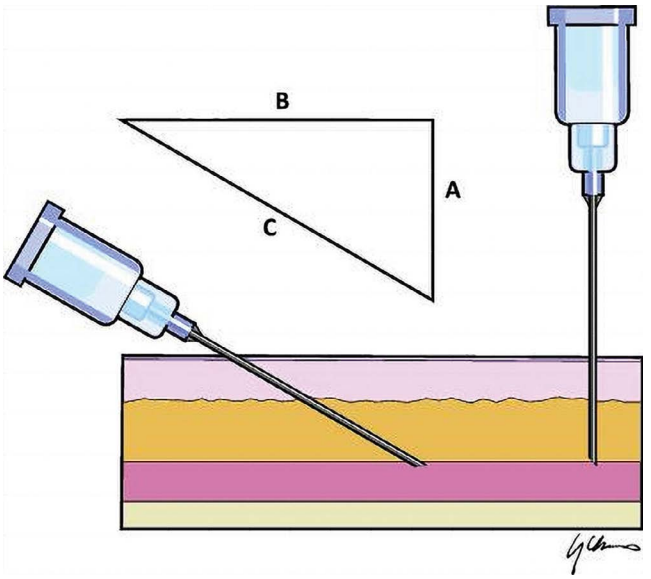

FIGURE 12.4 Vertical insertion of needle has a shorter distance to reach the targeted depth (route A and route C).

injection. The blunt tip of the cannula should still be exercised gently. Limited penetration via the skin utilizing the same portal to deliver fillers is less wounding for the patient and of course results in less bleeding (**Figure 12.5a–c**). Hesitation, clumsiness in a movement, a longer stay within the tissue, unnecessary repeat deliveries, and injection through painful areas all increase the rate and amount of bleeding and ecchymosis. Slow withdrawal of the instrument could avoid the release of the instrument tamponade. There are also different maneuvers of the guiding fingers to protect the area further throughout the injection process.

12.2.1.2 Edema, swelling, and distortion

Edema and swelling are a tissue reaction usually but not necessarily associated with bleeding. Trauma to the tissue could further worsen the condition. The tips to reduce bleeding could also be beneficial in reducing swelling. Repeated reinsertion of a cannula or a wide range of cannula exertion via a single hole irritates the entry portal more. A prolonged procedure, repeated penetrations, and aggressive movements result in more tissue disruption.

Injection of local anesthetics will result in temporary tissue swelling, especially with a tumescent agent. Injectors should keep this in consideration to avoid underestimating the amount of filler required.

Tissue damage from combined procedures such as ablative lasers or energy-based devices increases posttreatment swelling. Some fillers with ingredients that interact with tissue, like Radiesse (RA) and polycaprolactone (PCL), result in temporary swelling as well (**Figure 12.6a–c**). Hyaluronic acid (HA) fillers with a swelling tendency should not be used in the periorbital area and should be tapered in dosage. Delayed swelling, which can be the sign of an immune reaction or biofilm activation, should be treated seriously.

12.2.1.3 Pain and tenderness

Tissue trauma and bleeding result in pain and tenderness. What reduces bleeding and trauma is also helpful in reducing pain, too. Ice-packing, distraction, gate theory, topical anesthetics, comforting environment, and gentle movements all could help reduce pain during the procedure. Local infiltration changes the local topography. Injected anesthesia or other ways that block the nerve are not encouraged because all potential warning signals about danger are thereby muted.

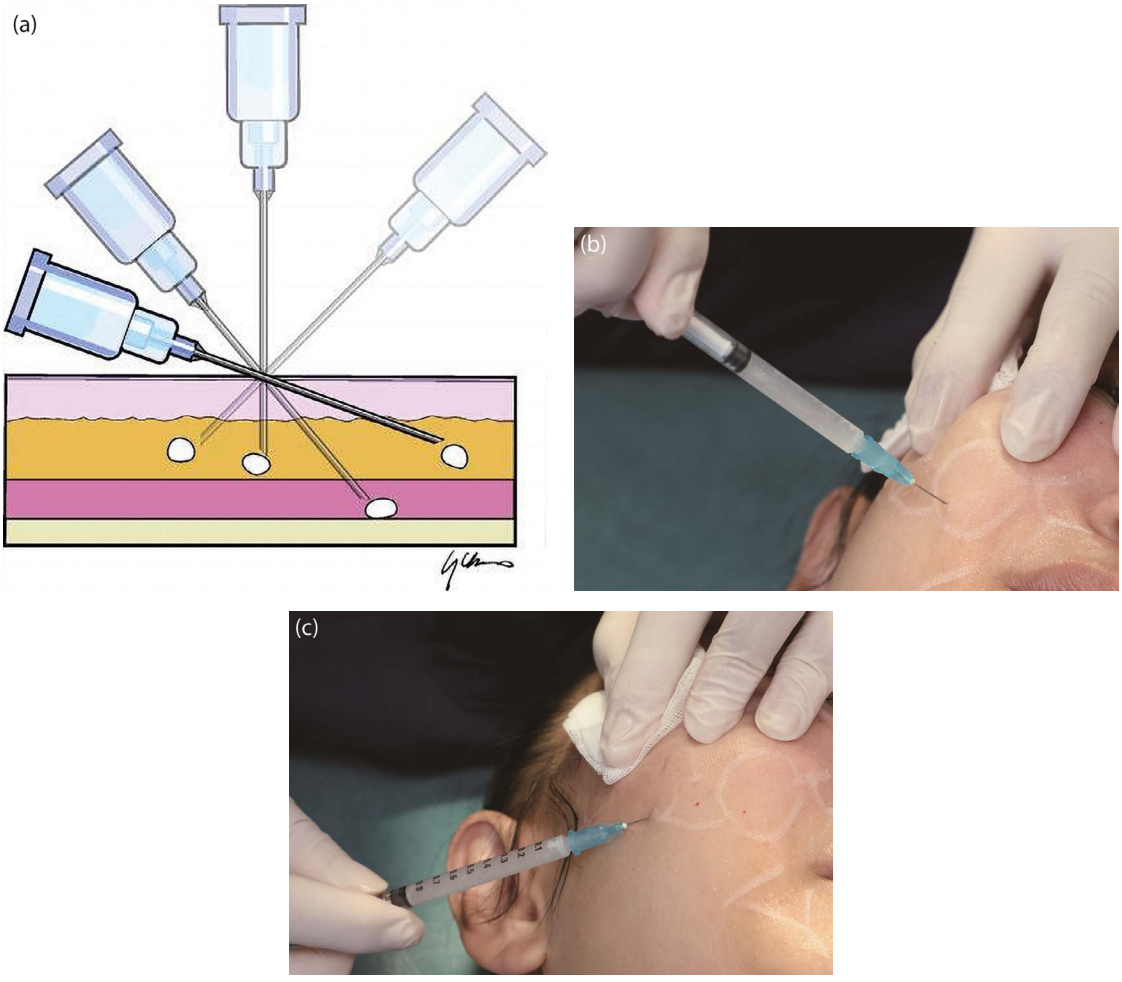

FIGURE 12.5 (a) Different angled penetration using the same entry hole can decrease the number of skin breaks and the amount of surface bleeding; (b) vertical access to the deep fat compartment with needles injecting Sculptra; (c) horizontal approach to the superficial compartment through the fanning technique for a zonal distribution.

Pain is the message conveyed by the nerves. Nerve damage would result in prolonged and more severe postinjection pain. A needle or cannula should be gently advanced out of a foramen where a nerve emerges. A hematoma, foreign body expansion, and supraperiosteal placement of firm fillers all could result in prolonged pain and tenderness. Choosing softer fillers, giving smaller aliquots, and avoiding insertion in tendinous or periosteal structures decrease these discomforts.

12.2.1.4 Surface erythema, allergy, and irritation

Prolonged erythema in the treated area could originate from infection, skin surface irritation, bleeding, and allergic tissue reaction, worsening of erythematous skin conditions, or vascular occlusion. The associated symptoms of pain, tenderness, swelling, warmness, stinging, vesicles, or pustules are valuable for a differential diagnosis. Allergic reactions or irritation usually are related to injection preparation and postinjection cares. Maneuvers of bleeding control should proceed by compression instead of wipes, especially in sensitive thin skin. Cleansing of injection fields could be accomplished with different choices of disinfectant based on the patient's previous history of contact allergy. Using commercial-pack facial

FIGURE 12.6 Radiesse injection of the chin for augmentation: (a) Before treatment, (b) 20 minutes after the injection, and (c) 2 weeks later.

masks or skincare products immediately after injection should be discouraged. Some behaviors involving repeated contact of contaminated hands and gauzes with the injection fields are problematic. Repeated wipe-pattern maneuvers to stop bleeding can also result in surface skin disruption.

12.2.2 Technique-Related Adverse Effects

Many inferior results from injection are related to decisions about esthetics and to injection technique more than to the filler substances themselves.

12.2.2.1 Unevenness

Uneven placement of fillers leads to an uneven surface. The techniques for even placement of fillers need to be studied very carefully. Superficial unevenness would be more discernable than that occurring deep because overlying soft tissue usually masks some errors. Postinjection massage can correct some faults during the procedure. However, an even distribution of the filler should not be dependent on postinjection redistribution. The expansion and spread of filler is less predictable than is precise deployment. Many injectable fillers should move or deform only minimally after being introduced in tissues.

Multiple parcels of filler can cover an area better than the same amount in a single large bolus. The arrangement of multiple aliquots using instruments is definitely a skill and an art. Things become more complicated when the volume has to cross ligament borders. Deep augmentation and superficial camouflaging have to be combined variably, depending on local structures and tissue laxity.

FIGURE 12.7 The same filler was injected in the same amount but at different depth in the prezygomatic region. Excursion of the levator muscles clumps the superficially deposited HA material and makes it appear as an elevation.

12.2.2.2 Asymmetry

Asymmetry is a common problem of suboptimal injection work. It can be easily detectable and is usually complained by the patient soon after the injection is finished.

Asymmetry can come with an asymmetric amount of fillers, asymmetric injecting locations, asymmetric injection depth (**Figure 12.7**), asymmetric curve pattern, asymmetric dimensions, and angles, or more complex 3D relationships. For an original symmetric structure that needs volume augmentation, everything done on both sides of the subject should be controlled equally in amount, injection instrument, injecting pattern, injecting depth, and injecting location (**Figure 12.8a** and **b**). Lighting is a great tool to help the injector to discern symmetry with its shadows; asymmetric light usually results in asymmetric result (**Figure 12.9**). Some other factors that could interfere with the judgment of symmetry are the common reasons for an asymmetric result, such as pain during injection, bleeding, incidental things like needle clogging, needle disconnection, and resistance during extrusion. A prolonged procedure, unexpected bleeding, trauma, and obstacles all result in further temporary swelling and temporary asymmetry. Injectors should aim for the final result.

Injections to treat an original asymmetry have to be well documented before the procedure and explained to the patient.

12.2.2.3 Poor curves

What can be called an elegant curve is an advanced discussion point with lots of esthetic theories and art behind it. However, it is extremely easy even for lay persons to notice something wrong with a face after poor treatments.

Poor treatments may result from inappropriateness in amount, location (**Figure 12.10**), incoherent design, unbalanced correction, suboptimal distribution, poor selection of fillers, overdosing, poor esthetics, abrupt transition, or unnatural dynamicity (**Figure 12.11**). It is suggested that injectors starting out use a conservative volume of filler; a holistic approach is extremely important for a balanced result. Use hand massage to merge the filling curve with the original structures; modifying the curve can be helpful for a better result.

FIGURE 12.8 (a) Sculptra was to be injected symmetrically in this middle-aged woman to treat bilateral problems. The injection process was largely smooth. Insertion point, depth, and amount are controlled to be equal. (b) The picture immediately after injection shows a similar extent and pattern of swelling with minimal differences.

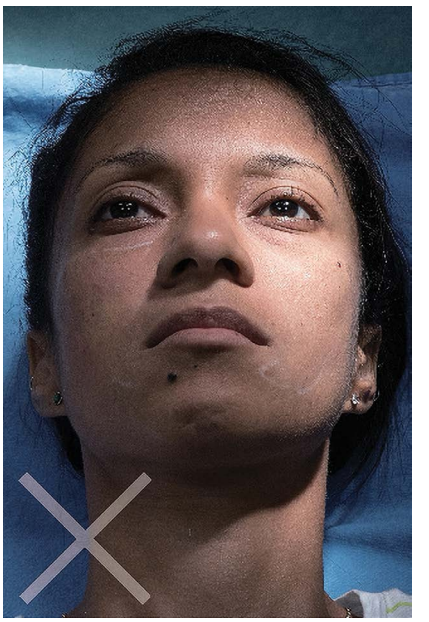

FIGURE 12.9 Light could be a great tool for showing problems but could be a problem in itself if set in the wrong direction. An incorrect judgment leads to incorrect decisions.

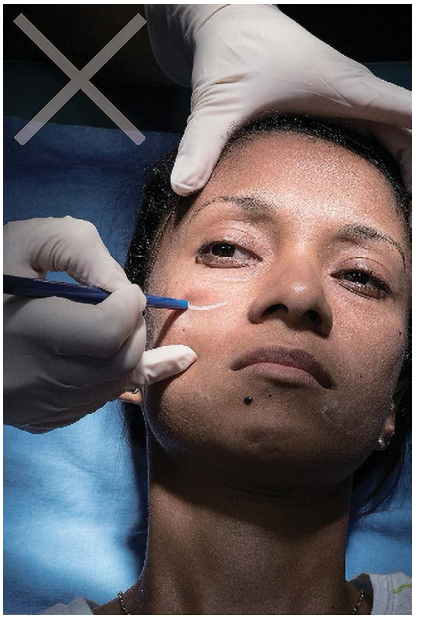

FIGURE 12.10 Gravity pulls tissue down and presents faces in what we see as the usual appearance, so the problems in an upright position are what concern us. So it follows that assessment and marking have to be finished when patients are upright.

12.2.2.4 Apparent margins

The existence of a foreign substance in tissues should mimic the original or hypothetical self-tissue and be like it as much as possible. A cyst is a lesion with its content collected together within an envelop. It is discernable with elevation, with a margin, and more apparent when situated superficially. Similarly, when fillers are used to provide volume but when grouped will be visible with margins, especially when filled superficially or unevenly (**Figure 12.12**). When the endpoint requires a lot of fillers, try to separate the fillers into multiple parcels and inject in different layers. Fresh hands can try to place them deeply. Feathering in the deposit and molding also help to blur the margins.

FIGURE 12.11 Overfilling usually results in odd but ugly appearances. The incorrect treatment becomes worse after the action of the elevator muscles, whereby bulging is distributed from medial cheek to lower cheek.

FIGURE 12.12 Bad treatments amended with bad further bad treatment give results that are even worse. This female patient received an uneven and overfilled fat transfer but has been treated with another uneven liposuction. Fibrosis and unevenness were then corrected with temporary fillers of different types. The different longevity of different fillers created many different interfaces that are both apparent and keep changing with time.

12.2.2.5 Lumpiness

Lumpiness describes a baggy appearance that usually gets worse during muscle excursion or shows some gravity dependency. It is also a problem of filler accumulation but related more to when the filler exceeds the carrying capacity of tissues. It usually comes from overfilling and occurs more with tissue laxity. Injection-related grouping of fillers, tissue integration, the creeping tendency of fillers, superficial placement, tissue redundancy, muscle contraction, and skeletal configuration are all interrelated.

Injection should be conservative and as deep as possible. Overcompensation with fillers or overenthusiasm in treating laxity with fillers is more worrying (**Figure 12.13**). Even though biostimulating agents like poly-L-lactic acid (PLLA) volumize through self-tissue formation, they could result in lumpy folds when overfilled.

12.2.2.6 Nodularity

Nodularity occurs when fillers are grouped and presents differently from lumps. This happens when fillers have a biostimulating or aggregating tendency, as with PCL, calcium hydroxylapatite (CaHA), and PLLA. Because of their immovable and undeformable character in combination with the new connective tissue, these aggregates are relatively firm and sometimes result in pain. Tips for prevention are similar to the scattering principles for preventing lumpiness. These fillers should not be injected into tendinous structures or muscles. PLLA suspension could be restricted or grouped when the injection is near ligaments or a large amount is poured into one location. Nodule rate increases when reconstitution concentration is high, the mixture is thickened upon precipitation, or there is contamination, overstimulation, or the sediments are injected through large-bore cannula or needles.

FIGURE 12.13 Sagging and retaining ligament connections create many grooves on the cheek. Sculptra has been injected in many sections to treat these grooves but it appears to have been used incorrectly in technique or with outmoded concepts. The PLLA liquid appears to have been infused in large quantities in compartments at both sides of the ligament, resulting in overstimulation and consequent tissue overgrowth. The sagging tissues could not bear the load and descended further, worsening the depression groove.

Steroid injection has been listed as one of the choices to resolve nodules in many literatures but should really be discouraged. That injection could hardly be restricted within the dense fibrotic lesion but diffuses to the surrounding tissue and usually leaves permanent atrophic changes (**Figure 12.14a** and **b**).

12.2.3 Product-Related Adverse Effects

Injection treatment must respect the specific character of each product to avoid unwanted posttreatment effects.

12.2.3.1 Periorbital and malar edema

Water equilibrium is an important characteristic for an HA filler to be selected for periorbital augmentation. Similar concerns are also valid for the malar space and lips (**Figure 12.15**). Thin skin and a tendency

FIGURE 12.14 Local steroid injection has been listed in many reports as one of the treatments to remedy nodules and overgrowth. (a) This woman complained about uneven distribution of her tissue growth months after an unequal PLLA injection. (b) Steroid injection was carried out by the same doctor to diminish the excess but only resulted in a more uneven atrophy.

FIGURE 12.15 A water-attractive HA product was injected for treating the tear trough and resulted in cord-like bulging under the eye with gel-like shine. The distribution of filler was asymmetric in depth and concentrated on the groove.

to swelling will let the filled foreign substance become visible after attracting water. Homogeneity is another quality of HA products to be considered when the injection is under delicate thin skin.

12.2.3.2 Widening distortion

Widening occurs when a grouped filler substance has been forced to separate or deform (**Figure 12.16a–c**), which often occurs and becomes a problem in the projecting part of the ridge or tip contours.

It has been debated whether the elasticity or cohesivity of a filler is a more important factor for maintaining shape. When compared to HA fillers with PCL or CaHA, HA products still retain their gel properties within tissues, while those carboxymethylcellulose (CMC) containing mixtures are more fixed in shape after solidification. When the comparison is between HA fillers, elasticity is the property to give a sufficiently strong shape; viscosity and cohesivity are the properties for it to remain in place and shape. Their rheological descriptions are just relative. Creeping and deformity occur in any case, just in different magnitudes and at a different pace (**Figure 12.17**).

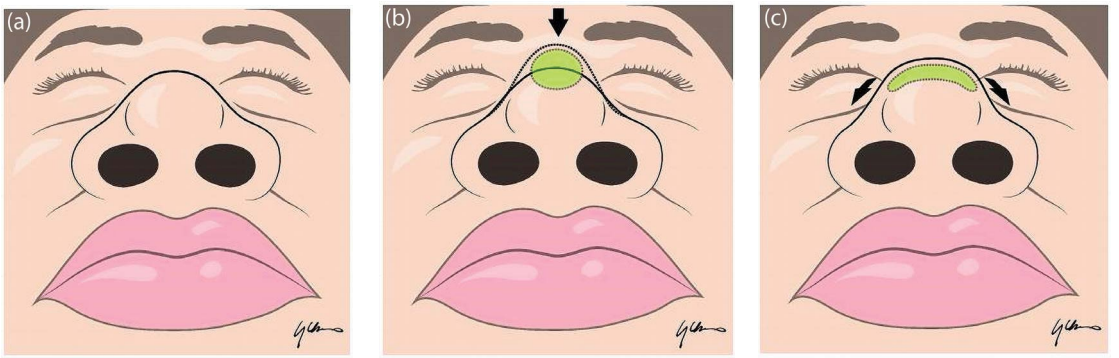

FIGURE 12.16 (a) A wide and flat nose has often been augmented with injectable fillers to raise the dorsum. (b) However, soft gels with a creeping tendency are not the filler for this indication. They may look good initially but (c) collapse days or weeks after and make the dorsum wider.

FIGURE 12.17 This patient was injected with an HA filler for the dorsum augmentation but was bothered by the gradual unsightly widening. What embarrasses the patient more is the translucent characteristic under lighting.

Needle injection separates the distribution more and limits the extent of lateral spread (**Figure 12.18a–c**). Cannula treatment groups the substance more initially but shaping that relies on the stacking of filler substances is not secure. A diminished shape or widening can be expected, especially for the chin and nose.

12.2.3.3 Colloid scattering

The Tyndall effect is named after the Irish physicist John Tyndall for his description of light being scattered by small particles. The intensity of scattering reflection is inversely proportional to the fourth power of the wavelength. That is why blue light is more scattered than the red light. By definition, Tyndall means the scattering of particles in size near the wavelength (40–900 nm); Rayleigh scattering means that phenomenon by particles smaller than the visible light wavelength and is weaker in intensity. HA particles are much larger and the bluish hue when fillers are implanted superficially also result from the colloid scattering.

This occurs more commonly in patients with fair color where there is a pooling of transparent substance in a superficial layer (see **Figure 12.15**). The nasal dorsum and the periorbital and malar area are often the locations. Injecting the filler deeper, minimizing the dose, and using materials that are opaque or could be finely scattered are all choices that could prevent this (**Figure 12.19a–c**). A pretarsal roll is a situation where light scattering is not completely avoidable. Patients should be warned before treatment.

12.2.3.4 Whitish discoloration

Just as with the colloid scattering of the transparent fillers when situated near the surface, opaque fillers could be visible and appear white when staying near the skin. Placing them deeper with adequate predilution can help decrease this situation. Linear threading and fanning are often not precise enough, with

FIGURE 12.18 (a) Restylane Lyft has been applied on the small and short nose by needle injection. (b) One month after and (c) 2 months after injection; photographs showed a well-maintained height and width without deformation and creeping migration.

unequal depth along the passes. Accumulation often occurs during serial threading fanning out from one entry point. Backflush of the filler can also be observed in the tracts of the needle and the cannula (**Figure 12.20a**). A residual substance in the superficial tract could become visible after recovery. Stop pushing earlier when withdrawing the instruments and maintain positive pressure on the entry when molding diminishes the backflow. Both dilution and adequate massage (**Figure 12.20b**) could decrease the rate of the whiteness visible through the skin (**Figure 12.20c**).

12.2.3.5 Fibrous adhesion

Biostimulating agents could induce fibrotic change and collagen formation when interacting with self-tissue. These new tissues adhere to each other and are stiffer than subcutaneous tissue. A second injection within these new tissues will face more resistance and tend to be expelled to the surrounding tissues. Vascular structures when embedded in the fibrotic tissue become more fixed. The extensibility of surface tissue decreases but the risk of intravascular injection increases.

Injectors have to avoid aggressive movements, listen more to patients' responses, use a cannula in dangerous zones, and prepare for further treatments by diluting and dispersing biostimulating agents in the first treatment.

12.2.3.6 Persistent pain

Fillers implanted in tissue take the place of the original tissue structures. It is a form of tissue dissection, especially when fillers are placed in large quantities and individual big amounts. Pain is more prominent

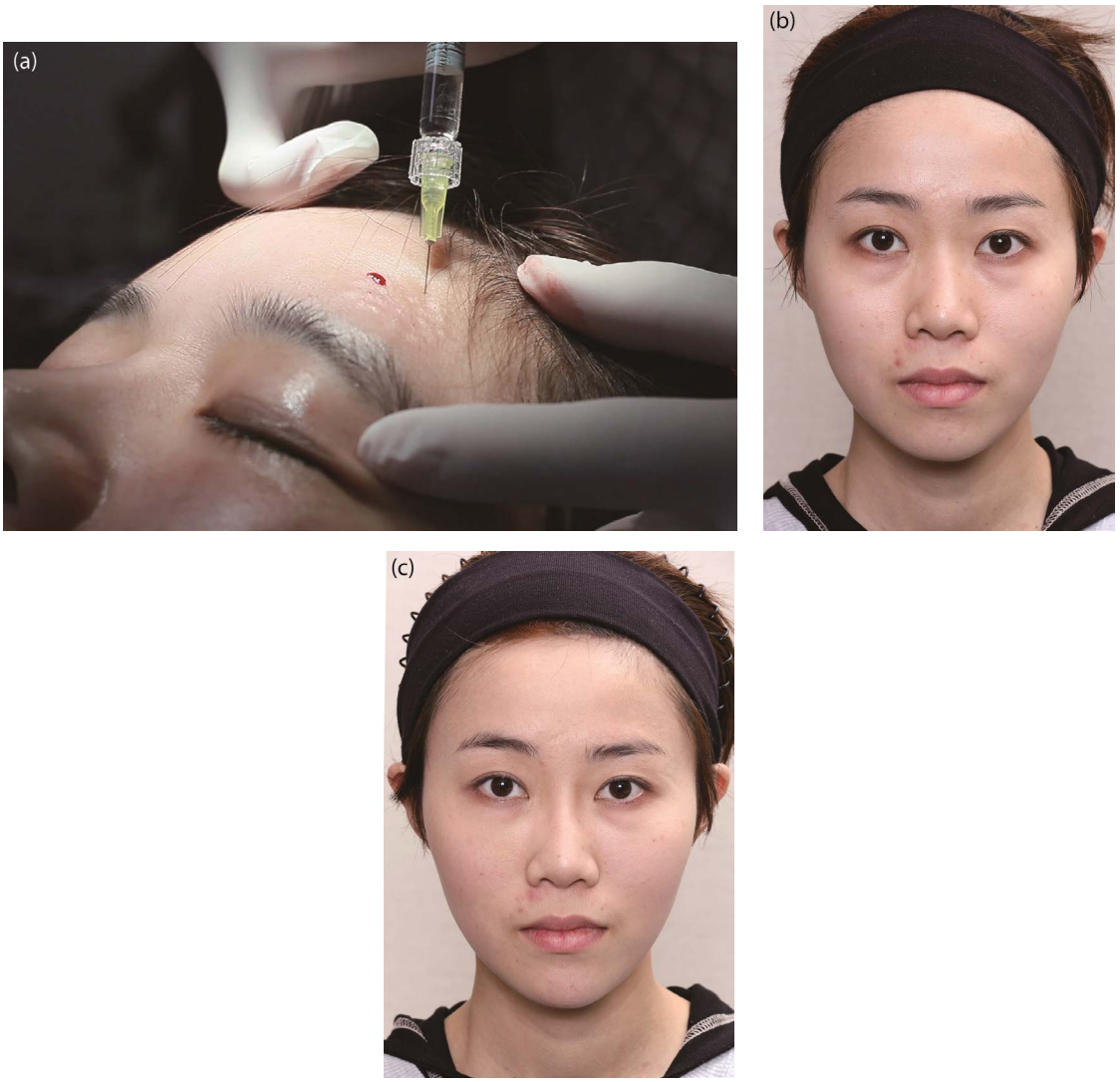

FIGURE 12.19 (a) Multiple superficial punctures of Restylane Skinbooster distribute the superficial droplet in place and help surface and contour enhancement. (b) Minor insufficiency in volume and (c) unevenness of the surface are well corrected by this treatment.

when the expansion is within the compact tissues of dermis, tendon, and ligaments. Clinically, pain occurs more on the chin, jawline, paranasal area, and temporal line. It is usually a benign process and will gradually diminish with time. Injection-related nerve injury can occur occasionally when an injecting needle or cannula hit the nerves. Deep injections should be cautious when directed in the infraorbital and infra-oral areas. A bolus PLLA injection can be delivered in smaller aliquots and a little away from the bone.

12.2.4 Esthetical Imperfections

Filler injection is absolutely an artistic work. Esthetic advancement is beyond the scope of this book, but the major imperfections in treatment could be prevented by proper injection techniques in the first place.

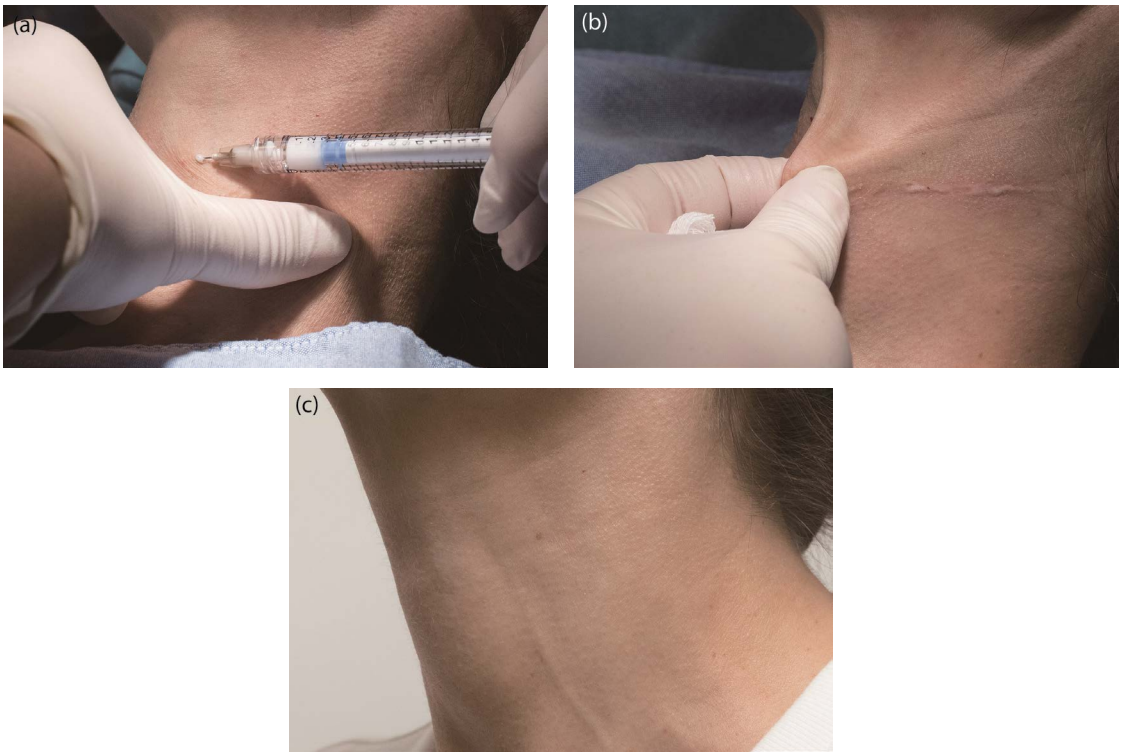

FIGURE 12.20 (a) The highly elastic Radiesse – even when diluted with lidocaine – shows the tendency to come out of the needle and the tract of injection. (b) Massages are mandatory for an even distribution of injected filler in tissue. (c) A smooth result 2 weeks after neckline Radiesse injection.

12.2.4.1 Poor proportion

Many odd looks after injection derive from the problem of proportion (**Figure 12.21**). One simple example is the upper-to-lower proportion of the lips and the lips to the entire face. Overconcentration on certain targets loses sight of a holistic consideration. The proportion of the face is interrelated and is 3D rather than 2D in

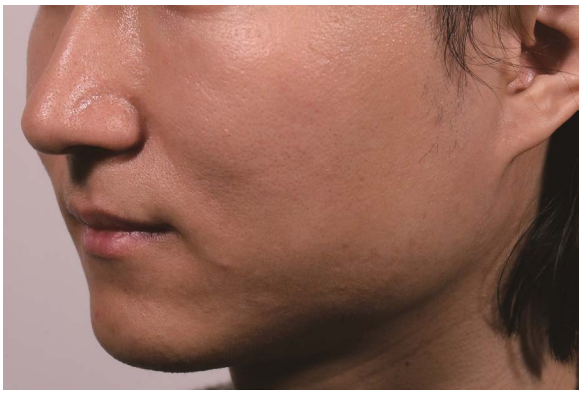

FIGURE 12.21 Fillers have been overfilled in this patient to treat the grooves of the cheek and augmentation of the mandible. Bulging of the medial cheek and the excessive curve on the side are inappropriate for males. However, the proportion of the mandible and the lateral cheek curve to the original nose, lip, and chin appear even more strange.

FIGURE 12.22 (a) Injection was conducted one week prior to treat a receding chin and lips with Restylane Lyft. (b) Erythema is still visible one week after, with better defined vermilion borders and more everted lower lip in better proportion. The chin is augmented with mild swelling with some feathering injection connecting to the lateral jawline for better coherence.

its relationships. The mythical golden ratio provides a preset frame into which believers can fit everything: if it is applied to stone or wood, the proportion is only the change in dimensions of the same material; when it occurs in live humans, augmentation with HA gel is next to one tissue and another tissue. A face short in longitudinal dimension – when eagerly filled to fit an oval proportion – could be overfilled in the chin. The proportion of lower face to the entire face changes; the ratio of the upper lip to lower changes even more. The problem can become worse when the mental area is limitedly distensible; the filled HA is then forced to extend laterally or bulge like a balloon with tethering dimples (**Figure 12.22a** and **b**).

12.2.4.2 Imprecision

Facial enhancement with fillers is more complex than sculpting a statue sculpting for the reasons just mentioned; it involves both the material's physical properties and a stratified dynamic tissue structure. The specification of location and amount of volume adjustment involves more than just medical science; it involves the esthetic recognition both of the shapes and contours of the subject sitting in front of you and of the envisaged ideal status. The difference between those two aspects is the area to accommodate your work. Failure to recognize the situation correctly leads to incorrect filler placement. Even after a correct diagnosis, an error in configuration for the new volume could appear incorrect (**Figure 12.23**).

12.2.4.3 Exaggeration

Exaggerated morphological correction by fillers has become an epidemic, especially in some wealthy areas. Such a culture has been ignited through media and social media by celebrities and is followed and imitated by the public. A tapered chin, full cheek, prominent cheekbone, or exaggerated mandibles are the examples. However, it is wiser to follow the principle that appropriateness is beauty and modest means elegant (**Figure 12.24a** and **b**).

12.2.4.4 Overcorrection

Fillers are indicated for some contours like grooves and wrinkles because those are associated with aging or negative emotions. However, these contours form because of the underlying ligaments or of contraction of muscle insertions. Overcorrection occurs when these injections erase these normal landmarks. For example, nasolabial folds and tear troughs can be found in the face since childhood. They are important

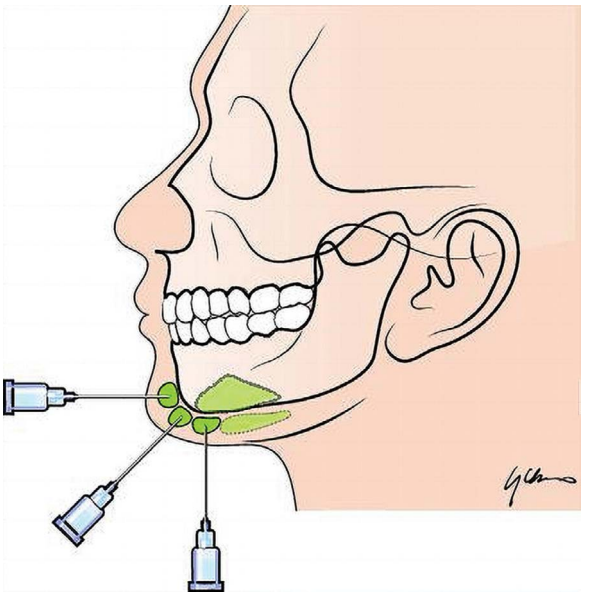

FIGURE 12.23 The direction of chin augmentation is crucial and the result under different injection directions will be totally different.

FIGURE 12.24 (a) Filler injection has been performed to correct the uneven surface of the forehead and bilateral concavity and temporal hollowness, and soften the mid and lower face skeletal appearance. Injection has been addressed with balanced placement and good feathering with respect to the original facial features. (b) The improvement is prominent but does not look odd.

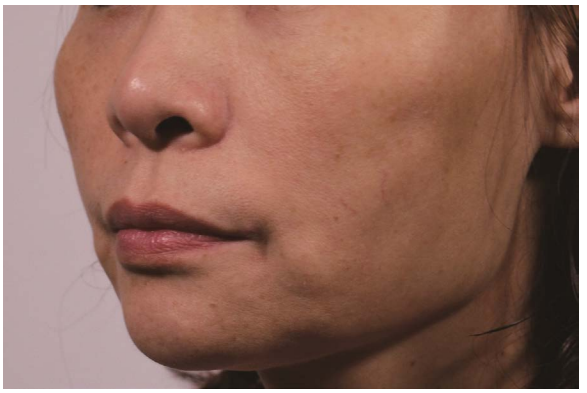

FIGURE 12.25 The nasolabial fold and tear trough are often incorrectly blamed and overfilled by patients and the injectors. The disappearance of this groove does not result in an improved appearance. Uneven placement of fillers and unnatural augmentation can also be visible on the cheek.

for contrasting the elevation of the cheek and the normal contour of eyelids. Obliteration of these depressions does not equate to youth but to flattened facial features and expressions (**Figure 12.25**).

12.2.4.5 Clumsiness

Clumsiness describes flaws in movements or poor dynamicity or it can present in a static form that hints at a similar dynamic situation. Volume elevation could appear during muscle exercise (**Figure 12.26a** and **b**), look saggy when put in the wrong location (**Figure 12.27a** and **b**) or lumpy if used in an excessive amount, and slow or unsmooth in movement when the volume interferes with normal muscle movements. Poor distribution of fillers or overloading in the superficial layer will result in grouping or unevenness under muscle traction. Descending, dislocation, or creeping deformation could result in poor dynamicity, and dynamic contours should be avoided accordingly (**Figure 12.28a–e**).

12.2.4.6 Incoherence

The shape and contour of a face convey messages. When the messages from different parts of the face conflict with each other or show little coherence, onlookers will recognize the difference and consider it unnatural. For example, a very full infraorbital region with the tear trough sealed by fillers can lack

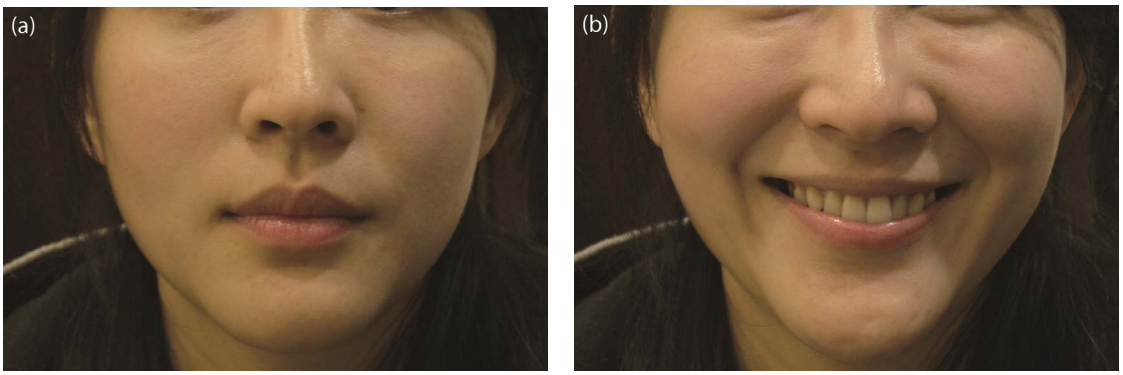

FIGURE 12.26 (a) A good looking injection result can be performed incorrectly because of (b) unsuitable substances and incorrect layering.

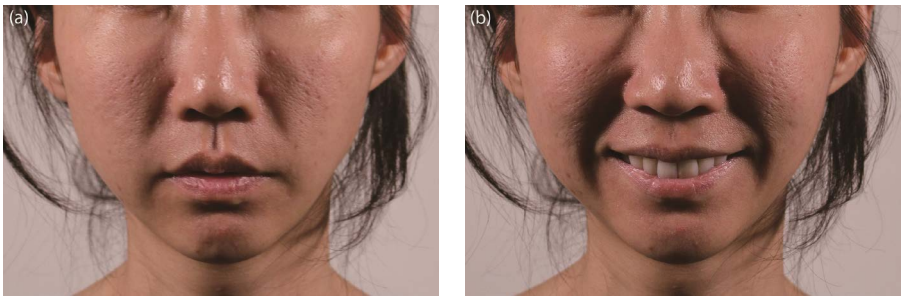

FIGURE 12.27 (a) The newly augmented cheek volume appears wrong in curve pattern, while the curve of the cheek hints at the movement pattern. (b) The real movement of the mimetic muscle proves the poor dynamicity of the incorrect injection.

FIGURE 12.28 (a) This young female is augmented with Restylane Defyne and Volyme for the forehead concavity, nose height and length, bimaxillary protrusion, and receded cheek and chin. (b) One week after injection with satisfactory correction, there is adequate projection and good convex curves. (c)–(e) Dynamic curves appear natural and normal in different expressions.

FIGURE 12.29 (a) This young woman has some problems that need injection correction but also obesity and a heavy arrangement of features. Injection for these challenging cases should respect the original features and make every new amendment coherent with the original curves. (b) Radiesse is used mainly for the forehead and chin for correction of the configuration. Belotero Intense is used to balance regional proportions.

coherence with unattended temporal hollowness and a superior orbital depression. Filler injection should be performed like a complete work under holistic consideration (**Figure 12.29a** and **b**).

12.2.4.7 Overinflation

As the practice of esthetic injection has become more commercial, patients have often been persuaded to agree to an amount greater than they need. The problem occurs more in PLLA because the onset time of its clinical effects could lag for several months; excessive products have been filled in during this period (**Figure 12.30**), but the growth has no antidote (as there is with hyaluronidase for HA).

FIGURE 12.30 Overfilling of PLLA has resulted in compartmental inflation of the cheek.

12.3 MAJOR COMPLICATIONS

Minimally invasive procedures can result in very severe complications. Every effort should be made to prevent these possibilities.

12.3.1 Tissue Necrosis

Tissue necrosis is usually associated with circulation deprivation, but infection and severe inflammation can also sometimes result in necrosis.

12.3.1.1 Circulation-related

Infarction of tissue could originate from obstruction of vessels including arteries or veins. Though compression has been attributed as the reason for some necrosis cases, the assumption is debatable because injection of fillers increases, to only a limited extent, the local hydrostatic pressure; this is much lower than is the case implanted prostheses, but the percentage of necrosis cases from fillers outnumbers that from surgeries (**Figure 12.31**). Large subdermal bolus injections behind the hairline have been reported to cause temporary and reversible alopecia.

Intra-arterial injection usually presents as sudden blanching of consecutively supplied areas, accompanied by severe pain (**Figure 12.32**). Venal obstruction usually onsets with dull pain and violaceous or gray darkening of the area, progressing less quickly. Vessel penetration should be avoided by the gentle use of a cannula, slow advancement of instruments, and choosing a cannula of larger caliber, for example, 21 or 22 G. A cannula is not a guarantee for safety as recent research has indicated that at 27 G both needles and cannulas can enter facial arteries with the same amount of force.

The structure of vessels is usually sensitive to pricks. Pain is a great warning signal for injectors to become aware of the possible dangers (**Figure 12.33**). The injector should stop, slow down, or turn an angle when mild pain occurs and stop and remove when sharp pain occurs. A needle employed as the

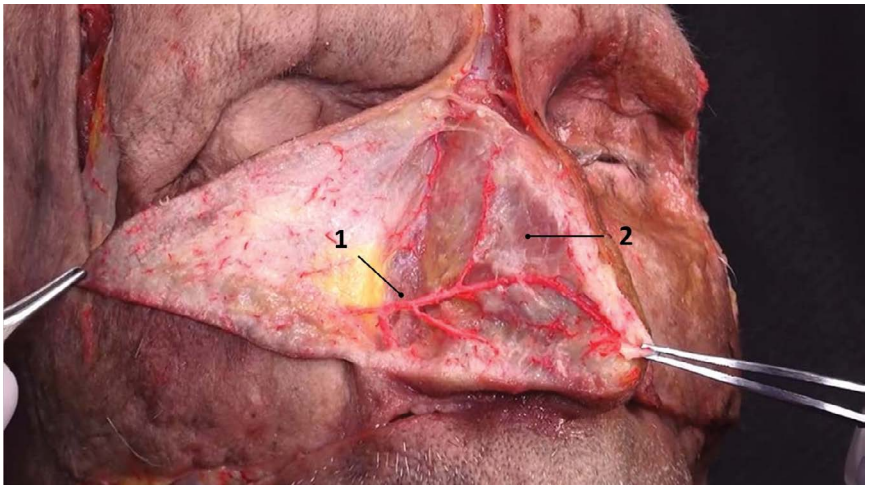

FIGURE 12.31 Cadaveric dissection of the nose highlighting the arterial vasculature. The arterial supply of the nose is provided by the facial (angular), dorsal nasal, and infraorbital vasculature with different supply patterns. Note that in a majority of cases, the arterial supply is located within the superficial fatty layer; however, it can be located in the supra-perichondrial and supra-periosteal plane. (1) Lateral nasal artery; (2) nasalis muscle.

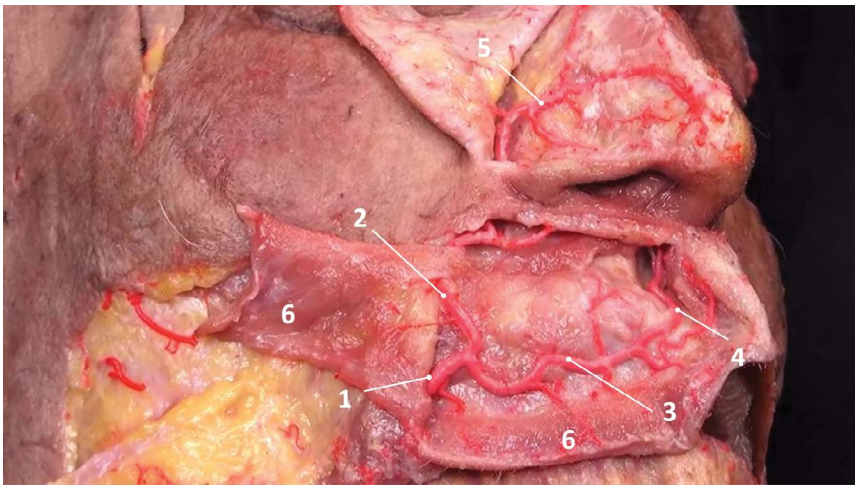

FIGURE 12.32 Cadaveric dissection of the upper lip and nose highlighting the arterial vasculature. The facial artery (1) is referred to as the angular artery (2) after the superior labial artery branches off (3). The superior labial artery gives off branches to the columellar (4). The arterial supply of the nose is provided by the facial (angular), dorsal nasal, and infraorbital vasculature. (5) Lateral nasal artery; (6) OOM.

injection instrument should be applied as deeply or as superficially as possible. Preinjection aspiration should always be performed. To avoid false-negative results, a 27-G needle at least should be used with preferentially a thin wall (**Figure 12.34**). Injectors should listen to patients' responses and avoid dangerous areas. They should also pay more attention to patients who have experienced surgery, implant, trauma repair, and fibrosis after a biostimulator injection. A dynamic injection mode should keep the instrument moving. Static injection in one fixed-point should avoid large doses in one spot. Avoid the repeated traumatizing passing of instruments. Injection should always be conservative in closed spaces.

FIGURE 12.33 Pricking a vessel is extremely painful. When the injection material is liquid PLLA, blood refluxes to the syringe when the needle inserts in the artery; aspiration soon gets blood when it inserts in the vein. However, aspiration shows less effect for viscous gels and could be ineffective for very cohesive and very viscous materials.

FIGURE 12.34 Aspiration when the needle steadily touches the bone for seconds is mandatory for some viscous or cohesive products.

12.3.1.2 Infection-related

Delayed treatment or severe inflammation of infection could result in tissue necrosis as well. Herpes simplex virus (HSV) activation and bacterial infection lead to soft tissue necrosis. Vascular occlusion can be complicated, with superinfection resulting in more extensive necrosis. Precautions for preventing injection-related infection (see Section 12.3.3) should be emphasized.

Injection-related infection usually onsets rapidly and just a little slower than vascular accidents. Vascular obstruction necrosis should be treated with sufficient wound cleansing, hyperbaric oxygen, and oral antibiotics. The attitude toward debridement should be the same as those from other reasons.

12.3.2 Blindness

Major adverse events of soft tissue filler injections are related to the inadvertent injection of the product into the arterial circulation. Complications arise when the filler then occludes the most distal and end branches of the arterial vasculature that supplies vulnerable tissues without collateral supply. The material causes a complete occlusion of the lumen, leading to ischemia due to loss of perfusion. Generally speaking, the vascular supply of the head and neck region is provided by branches of the internal and external carotid arteries. While the internal carotid artery typically supplies the neurocranium, including the brain and the cranial vault, the external carotid artery supplies the viscerocranium, including the face, lips, and the oral and the nasal cavities. It should be noted that multiple anastomoses exist between this internal and external blood supply; the ophthalmic artery in particular needs to be highlighted as an anastomotic pathway between the extracranial and intracranial arterial system (**Figure 12.35**). Blindness from injection could be understood as the injected material having entered the vessels supplying the vision-related circulation. The face is supplied by the branches of both the internal and the external carotid artery systems, which connect with each other in the periorbital region. The main connecting artery is the ophthalmic artery that arises from the central retinal artery. Any location of the face is connected via its arterial blood supply to the ophthalmic artery. Therefore, no region of the face can be considered to be 100% safe. Application of filler materials can result in an intra-arterial product application and the respective material can be transported into the ophthalmic artery circulation. The product can directly obstruct terminal arterial blood flow to the retina, but the arterial supply can also be affected by intrinsic damage from the product. This intrinsic damage can be damage to the intima of the vessel wall or be caused by

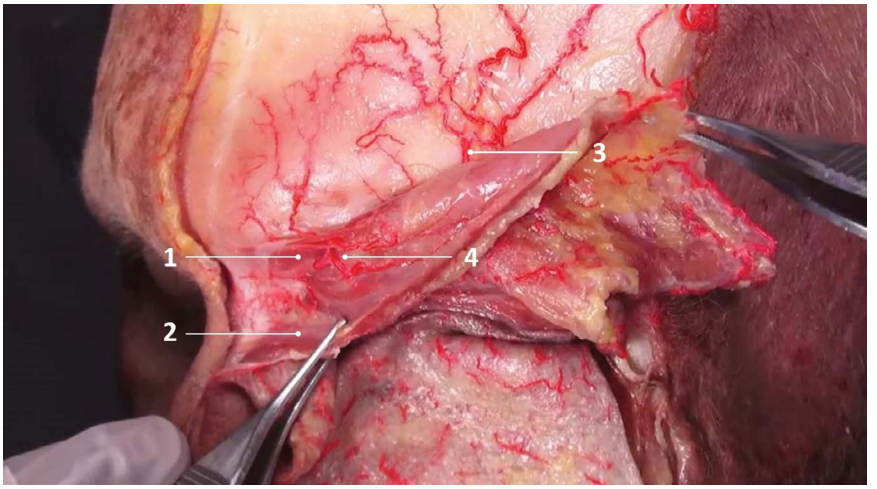

FIGURE 12.35 Cadaveric dissection of the left glabella region. The origin of the corrugator supercilii muscle (1) can be found at the supraciliar arch of the frontal bone, medial to the emergence of the supraorbital neurovascular bundle. Note also the bony origin of the procerus muscle (2) at the nasal bone. (3) Supraorbital artery; (4) supratrochlear artery.

the activation of the coagulatory system. The latter can cause additional thrombo-embolic obstruction of the arterial blood flow.

Transfer of injecting materials from the external system vessel to the internal system and intra-arterial obstruction needs to move against the flow. Vascular complications can occur irrespective of whether the injector uses a needle or a cannula. Although cannulas possess a blunt, rounded tip, the pressure required for penetration decreases and the device behaves similarly to a needle as the diameter decreases (i.e., a 27-G cannula). Vascular complications are feared due to the manifold anastomoses between the internal (ophthalmic artery) and external carotid artery (facial artery) vascular territories. In particular – but not exclusively – the glabella region is considered high risk, as the supratrochlear, supraorbital, and dorsal nasal artery are branches of the ophthalmic artery, which also provides the vascular supply of the retina via the central retinal artery. If a bolus of hyaluronic acid is injected in one of these vessels in the glabella region, and the injection pressure overcomes the systemic blood pressure, the product proceeds retrograde into the ophthalmic artery. Once the pressure is reduced from the plunger, the product might then migrate in an anterograde direction into the central retinal artery, which branches off the ophthalmic artery and enters the optic nerve at its most narrow location. If the product occludes this artery, tissue necrosis of the retina is induced, ultimately causing blindness. Blindness after soft tissue filler injection can occur after arterial penetration in all facial regions, including nose, glabella, forehead, and nasolabial fold, in the decreasing order of number of reported cases. Though the mechanism sounds a complicated pathway, tragedies have occurred. Injection into the artery could be imagined as a painful and forceful injection. Injection under a regional block, deep sedation, or general anesthesia all numb the responses of the patient.

Preinjection aspiration is a safety measure employed to prevent intravascular injection. A retrospective clinical study analyzed over 200 cases of positive blood aspirations after soft tissue filler injections. In terms of the facial region targeted, most aspirations were encountered when injecting the pyriform fossa, followed by the deep midfacial fat compartments, the anterior superior temple, and the chin. In addition, by far the most common plane of injection where aspiration of blood occurred was supraperiosteal (>90%), followed by the subdermal plane (8.0%). Moreover, the needle size and priming of the needle significantly affected the rate of aspiration. Most positive aspirations were found for 27-G (58.7%) needles, followed by 25 G (20.7%) and 29 G (16.9%), and most aspirations occurred in needles that were primed prior to injection. In almost 99% of cases, blood was visible after less than two seconds of aspiration. Given the results

of this study, the following recommendations can be deduced: aspiration should be performed for at least two seconds; pullback volume should be adequate (>0.2 cc); and a suitable product/needle combination should be chosen, with larger needle diameters for more viscous products.

12.3.3 Infections

The minimal invasiveness of the injection process does not mean the possibility of pathogen invasion is minimal. On the contrary, because of the implantation of foreign materials, it is even more important to keep the injection field and process clean.

12.3.3.1 Wound infection

Injection wounds include the wounds of needle puncture, possible abrasion or irritation during preparation, and the injection process. Gloves, a marking pen (**Figure 12.36**), gauze, and soiled needles could all be the source of contamination to introduce a pathogen to the wounds and enter tissue with the filler (**Figure 12.37**).

The skin experiencing injection should be cleansed as normal but kept from cosmetics, skincare products, a sauna, or swimming for 1 to 3 days beforehand, depending on the severity of the surface disruption. Every palpation, molding, adjustment, and reevaluation during the injection process should be accompanied by re-cleansing if further injection is still intended in the same area.

PLLA postinjection massages should proceed with medical-grade agents, using clean hands. Injection in oily skin or skin with comedones and acne is prone to be contaminated from the follicular-sebaceous unit, especially when injecting within superficial layers. Posttreatment antibiotics should be considered.

12.3.3.2 HSV reactivation

Patients with active HSV should be deferred from injection; frequent HSV sufferers should be premedicated. Any eruption around the injection should be medicated with ORAL antiviral agents.

12.3.3.3 Biofilm formation

Any injecting materials should not be combined with thread, permanent fillers, tissue implants, or concomitant surgeries. The pathogen could be transmitted from one to another successively. Injection introduces certain loads in any case; fixing threads carry even more load through the insertion process.

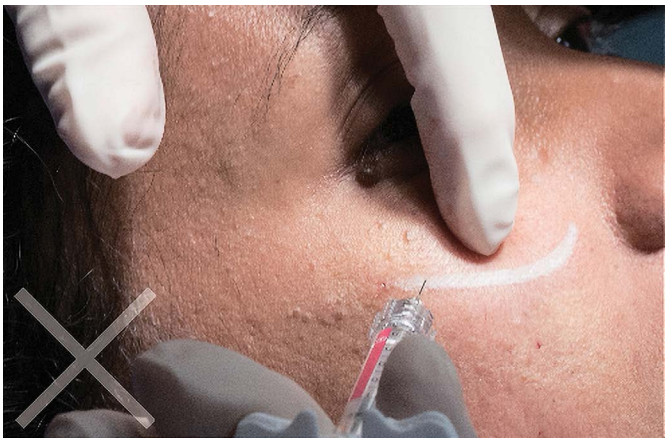

FIGURE 12.36 A needle piercing the skin on a marking – even after a swipe of disinfectant – is not clean.

FIGURE 12.37 Bending the needle with a soiled hand contaminates the needle. Most of the injection field is not prepared in a sterile fashion.

Ablative lasers or surgery should be conducted carefully with high-standard hygiene in filler-filled areas. A combination of fillers should be in different areas or different layers. Mixing of fillers is not preferred, especially mixing in tissues with residual fillers. The previous injection treatment could also lead to a biofilm condition with this treatment when injection is introduced to encounter the previous contaminated filler material in tissue. Patients with a systemic bacterial infection or local infection near the injection fields should only be allowed for treatment after the infection subsides.

12.3.3.4 Mycobacterium

Outbreaks of mycobacteria have been reported more with meso-patterned injections. Mycobacteria are in the environment, especially in tap and potable water. Prevention should be emphasized, with injection hygiene throughout the process and handling of the injection products. For disinfectant to prevent contamination, the injector can consider glutaraldehyde. Ethyl and isopropyl alcohols are effective but their rapid evaporation limits the contact time. Iodophors are effective but stain the skin.

12.3.3.5 Abscess

A bacterial outbreak could happen in contact with pathogens immediately after injection or as a reactivation of the biofilm. Injection-related abscess formation is often subacute or delayed and related to biofilm activation. Bacterial infections associated with foreign bodies are notoriously difficult to control by systemic antibiotics. Injected filler substances should be drained out if possible. Any residual foreign body not completely removed could become a reserve of future biofilms.

12.3.4 Immune Reactions

Traditionally, injecting materials are considered ideal if they are biocompatible with no tissue reaction. This concept has been changed in that more and more injectable fillers are designed to stimulate tissue reactions, such as collagen formation. Many linear fillers that were supposed to be inert have been claimed to stimulate collagen as well. Increasingly, HA filler-treated patients are reported to have delayed immune reactions.

12.3.4.1 Foreign body overreaction

Biostimulation agents elicit tissue reaction via a foreign body reaction. Linear fillers have similar reactions as well, especially those with a higher degree of modification. Compared with PCL and CaHA, the magnitude of reaction and extent of tissue formation in PLLA is more profuse. There are variable details of preparation, injection techniques, types of targeted tissues, immune status of the patient, disease, and medication, and postinjection care. Tissue reaction often takes time. The injection should be scheduled to respect the patients' response or following a standard protocol. Overcorrection has become a common and serious issue with ballooning faces; and that could cause a severe problem for 3 to 4 years.

12.3.4.2 Hypersensitivity

Unwanted immune reactions – albeit rare – have been recorded and reported toward certain filling materials. An immune reaction of the host against filling substance usually results in a generalized reaction in all the injected areas, but biofilm reaction is more restricted in contaminated focus. Erythema, swelling, pain, and tenderness are often the presenting symptoms. Immunogenicity toward an implanted polymer is related to host factors, including HLA type, and material factors, including particle shape, size, surface condition, charging, components of the filler itself, and concomitant ingredients. Sensitized fillers should be removed, controlled by anti-allergic medication, and prohibited from further use in these patients with reactions.

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