1 Epidemiology of Cosmetic Procedures

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Abstract

Dermal fillers have emerged as a popular nonsurgical cosmetic option for facial enhancement and rejuvenation. This chapter provides a comprehensive overview of dermal fillers, including their applications, advantages, and potential complications. Various types of fillers are discussed, such as hyaluronic acid, calcium hydroxylapatite, and poly-L-lactic acid, each with unique properties. The FDA has approved dermal fillers for patients aged 22 years and older to correct facial wrinkles, increase fullness, and address specific conditions like HIV lipodystrophy and acne scars. Demographics show increasing popularity across age groups, including millennials using fillers preventatively. Studies indicate safety and efficacy across different skin types and ethnicities. Beyond cosmetic uses, medical applications include treating HIV facial lipoatrophy and gender dysphoria. Common treatment areas include cheeks, lips, nasolabial folds, and tear troughs. While various healthcare providers can administer fillers depending on local regulations, the expertise of the injector is crucial for patient satisfaction and safety. Potential adverse events and litigation factors are briefly mentioned. Overall, dermal fillers offer effective results when administered by knowledgeable practitioners, though patients should be aware of both benefits and risks.

Keywords: fillers, cosmetic, hyaluronic acid, poly-L-lactic acid, calcium hydroxylapatite

1.1 Introduction

In recent years, dermal fillers have emerged as a popular cosmetic, nonsurgical option to enhance facial features, smooth out wrinkles, restore volume to the face, and add contour to a number of other body parts.[1] In 2021, dermal fillers were the second most popular nonsurgical procedure for all genders and ages (▶ Table 1.1; ▶ Table 1.2).[2] There are a number of different types of dermal fillers such as hyaluronic acid, calcium hydroxylapatite, poly-L-lactic acid, etc.—each with its own unique properties and risks/benefits. In the hands of a knowledgeable and experienced practitioner, dermal fillers can produce natural-looking results that enhance a person's appearance and boost their confidence. In this book, we aim to provide a comprehensive overview of dermal fillers, including their applications, advantages, and potential complications. By discussing their uses, benefits, and risks associated with this popular cosmetic option, we hope to equip you with the knowledge necessary to determine whether dermal fillers are a suitable option for your needs.

Table 1.1 Top nonsurgical procedures: total and gender identity[2]

Top procedures	Total	Men	Women
1. Neurotoxins	3,651,223	155,882	3,474,160
2. Dermal fillers	1,857,339	69,450	1,777,989
3. Skin treatments*	1,390,149	47,999	1,323,811
4. Hair removal	454,954	28,824	423,861
5. Laser skin treatment combinations	431,485	26,430	400,255
6. Skin tightening	391,855	22,513	374,030

*Chemical peels, hydrafacials, etc.
Source: Data from Aesthetic Plastic Surgery National Databank Statistics 2020–2021. Accessed at: https://cdn.theaestheticsociety.org/media/statistics/2021-TheAestheticSocietyStatistics.pdf (page 7).

Table 1.2 Top nonsurgical procedures: by age[2]

Age (in years)	Percentage
17 to 35	17
36 to 50	41
51 to 70	37
71+	5

Source: Data from Aesthetic Plastic Surgery National Databank Statistics 2020–2021. Accessed at: https://cdn.theaestheticsociety.org/media/statistics/2021-TheAestheticSocietyStatistics.pdf (page 9).

1.2 Epidemiology of Patients and Practitioners

The FDA has approved the use of dermal fillers in patients 22 years and older for correcting moderate to severe facial wrinkles and folds, increasing fullness of various areas of the face, restoring HIV lipodystrophy, and correcting acne scars on the cheek.[3] Injectable fillers can also be used off-label in transgender patients for feminization or masculinization.[4,5] Following botulinum toxin, dermal fillers are the second most common minimally invasive cosmetic procedure.[6] The 2020 Plastic Surgery Statistics Report reported that cosmetic procedures are most often performed on 40- to 54-year-olds, and over 90% of all cosmetic procedures are done in females.[6,7] These cosmetic procedures are completed in older individuals with more visible signs of aging as well. Yezhelyev et al conducted a retrospective review of the CosmetAssure database (183,914 cosmetic surgical procedures), which showed there is no statistically significant difference in the risk of complication rates between elderly patients (age 69.1 ± 4.1) and younger patients (age 39.2 ± 12.5) receiving any cosmetic procedure, including injectable fillers.[8] While fillers have long been popular among 40-year-olds and older, they are becoming increasingly popular among millennials as well.[9] The American Society for Dermatologic Surgery published a survey in 2016 citing a 100% increase in injectable filler procedures in patients under 30.[10] This age group is utilizing the technique as a form of aging prevention.[9] A prospective study focusing on the demographics of minimally invasive cosmetic surgery patients conducted in 2010 found that of the 336 patients surveyed and participated in minimally invasive procedures, 67.5% were married, 67% were college-educated or greater, 74.3% were employed, and 74.5% were mothers.[11] According to a 2018 survey conducted by the American Society for Aesthetic Plastic Surgery, ethnic minorities comprised 29% of the cosmetic procedures in the United States, which included dermal fillers and neuromodulators.[7] This was further broken down into 13% Hispanics, 9% African Americans, and 6% Asians (▶ Table 1.3; ▶ Table 1.4).[7] A multicenter study looking to assess the safety and effectiveness

Table 1.3 Cosmetic procedures: by race/ethnicity[6]

Ethnicity	Total number *(in millions)*
White	10,330,749
Hispanic	1,985,351
Black or African American	1,781,485
Asian American	1,207,619
Other	290,751

Source: Data from Plastic Surgery Statistics Report 2020: ASPS National Clearinghouse of Plastic Surgery Procedural Statistics. Accessed at: https://www.plasticsurgery.org/documents/news/statistics/2020/plastic-surgery-statistics-full-report-2020.pdf (page 24).

Table 1.4 Percentage of nonsurgical procedures[6]

Ethnicity	Percentage
White	66.2
Hispanic	12.7
Black or African American	11.4
Asian American	7.7
Other	1.9

Source: Data from Plastic Surgery Statistics Report 2020: ASPS National Clearinghouse of Plastic Surgery Procedural Statistics. https://www.plasticsurgery.org/documents/news/statistics/2020/plastic-surgery-statistics-full-report-2020.pdf

of fillers in darker skin types examined 93 patients with Fitzpatrick skin types IV, V, and VI who received hyaluronic acid injectable filler.[12] The study found that the hyaluronic acid filler was effective for treatment of nasolabial fold depression in these patients, and there was no association with hyperpigmentation, hypopigmentation, or scarring.[12] Another study looking at the safety and effectiveness of hyaluronic acid fillers in different Fitzpatrick skin types was a randomized, double blind study conducted by Grimes et al.[13] The group examined the effects of one of three high concentration hyaluronic acid fillers (24 mg/mL) in the nasolabial fold of one treatment arm, and in another treatment arm, participants received one of three low concentration (5.5 mg/mL) hyaluronic acid fillers in the nasolabial fold.[13] The high concentration group had no hypersensitivity or hypertrophic scarring, and there was no increased hyperpigmentation or hypopigmentation when compared to Caucasian subjects.[13] In the low concentration group, there was also no hypertrophic scarring, hypopigmentation, or hypersensitivity, but there were three instances of mild hyperpigmentation.[13] All of the fillers in the high and low concentration groups proved to be effective at 24 weeks.[13]

Beyond the cosmetic purposes for filler, there are medical applications for filler, including HIV facial lipoatrophy and gender dysphoria, which is an important consideration as the transgender population continues to increase.[14] Poly-L-lactic acid is a biodegradable, resorbable synthetic polymer that is FDA approved for HIV facial lipoatrophy but is also used off-label for age-related lipoatrophy.[3,15] In a study of 50 patients with HIV lipoatrophy who received four sets of injections, no significant adverse events were observed.[16] In 22 patients palpable subcutaneous nodules were noted, which resolved spontaneously.[16] More papules and nodules were observed in the periorbital area.[16] Two European HIV-related lipoatrophy studies found subcutaneous nodule incidence rates of 52 and 31%, while American HIV-related lipoatrophy studies found these nodules at much lower rates of 6 and 13%.[15] Although not FDA approved, there may be some utility for this substance for lipoatrophy due to medical reasons in children as well, although this has yet to be studied.[17]

Dermal fillers are typically injected into the face, neck, and hands.[4] Given the effectiveness of botulinum toxin for wrinkles and folds in the upper one-third of the face, fillers are often used in the lower two-thirds of the face.[4] Common facial filler treatment areas include the cheeks, lips, nasolabial folds, marionette lines, tear troughs, and forehead. Rayess et al conducted a cross-sectional analysis of adverse events and litigation. This analysis looked at 1748 adverse events, of which swelling and infection were the most common. The cheeks and lips were most frequently cited locations for adverse events, and inadequate informed consent was the most common factor cited in litigation.[18]

Dermal fillers can be administered by a variety of healthcare providers, depending on local legislation.[19] For example, in California, fillers can be injected by licensed vocational nurses, also known as licensed practical nurses, whereas in Alabama, fillers must be injected by a physician.[19] In a survey of 383 women aged 35 to 69 who were considering cosmetic treatments within the next 2 years, over 90% of respondents took into account the expertise of the injector, whereas only 55 to 60% considered the cost of the procedure to be a factor.[20] Due to the many different agents and the variety of complications, physicians, such as dermatologists and plastic surgeons, who are familiar and experienced in anatomy, medical complications, and filler components are best suited to perform these injections.[4]

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2 Pre-Injection Planning

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Abstract

The use of injectable soft tissue fillers has increased significantly in recent years, with 1.6 million injections administered in 2018. While generally considered safe, adverse events are reported in approximately 1 in 3600 patients. Comprehensive pre-injection planning is crucial for achieving desired aesthetic results and minimizing complications. This chapter emphasizes the importance of understanding facial aging processes, facial anatomy, and various injection techniques and products. Key components of pre-injection planning include thorough patient evaluation, setting realistic expectations, and reviewing potential adverse events. The chapter highlights the significance of proper documentation through consistent photography, obtaining informed consent, and selecting appropriate filler products. Anatomical considerations are emphasized as crucial factors in achieving optimal outcomes. The text also stresses the importance of aseptic technique and proper counseling to ensure patient safety and satisfaction. By focusing on these pre-injection planning elements, practitioners can help patients achieve their aesthetic goals while minimizing the risk of adverse events. This comprehensive approach to pre-injection planning is essential as the popularity of filler injections continues to rise.

Keywords: fillers, planning, photography, consent, counseling

2.1 Introduction

The use of injectable soft tissue fillers has increased by 78% in the past 7 years with a total of 1.6 million injections administered in 2018.[1] Although generally considered as a safe cosmetic procedure, a 10-year-period analysis (2007–2017) estimated that 1 in 3600 patients has a reported adverse event following receiving an injectable filler.[2] With increased popularity of filler injections, the incidence of adverse events is likely to increase. Comprehensive understanding of the aging process, proper knowledge of facial anatomy, and appropriate knowledge of different techniques and products are fundamental in ensuring desired aesthetic results and in avoiding complications. Proper evaluation of the patient, setting expectations, and reviewing adverse events are important steps in the preprocedural planning.

2.2 Anatomical Considerations

The youthful face has been represented as an isosceles triangle with wider top pointing downwards at the temples and cheek bones.[3] Age-related sagging, which starts in the third decade of life, produces an inverted triangle (▶ Fig. 2.1); fat pads underlying the skin descend, infraocular fat pads descend and rotate medially, orbital fat in the eyelid pseudo-herniates, hyperfunctional rhytids such as frown lines occur, nasolabial folds, and jowls become more prominent, and tear troughs and temporal hollows deepen.[4,5]

Racial variations exist in aging face and need to be taken into consideration when assessing patients.[6] For example, the aged African American face typically exhibits more midface and eyelid laxity, with pseudo-herniation of the orbital fat pads and prominent nasolabial folds. On the neck, blunting of the cervico-mental angle is generally more notable than the fine wrinkles in older whites (▶ Fig. 2.2). In Latina patients, aging causes a thicker, fuller midface, with excess skin and sagging of the upper and lower eyelids; nasolabial folds may become prominent, but the chin is often recessed. In Asian patients, the mandible is wider versus white faces. Asian and African noses have a wider base but a less tall tip than noses of white patients. Typical Asian faces have an intercanthal distance greater than those of white patients.

Knowledge of the facial anatomy is essential in preventing complications from dermal filler injections. The facial vasculature has many variations and can be found in various tissue planes depending on location within the face.[7] Anticipating

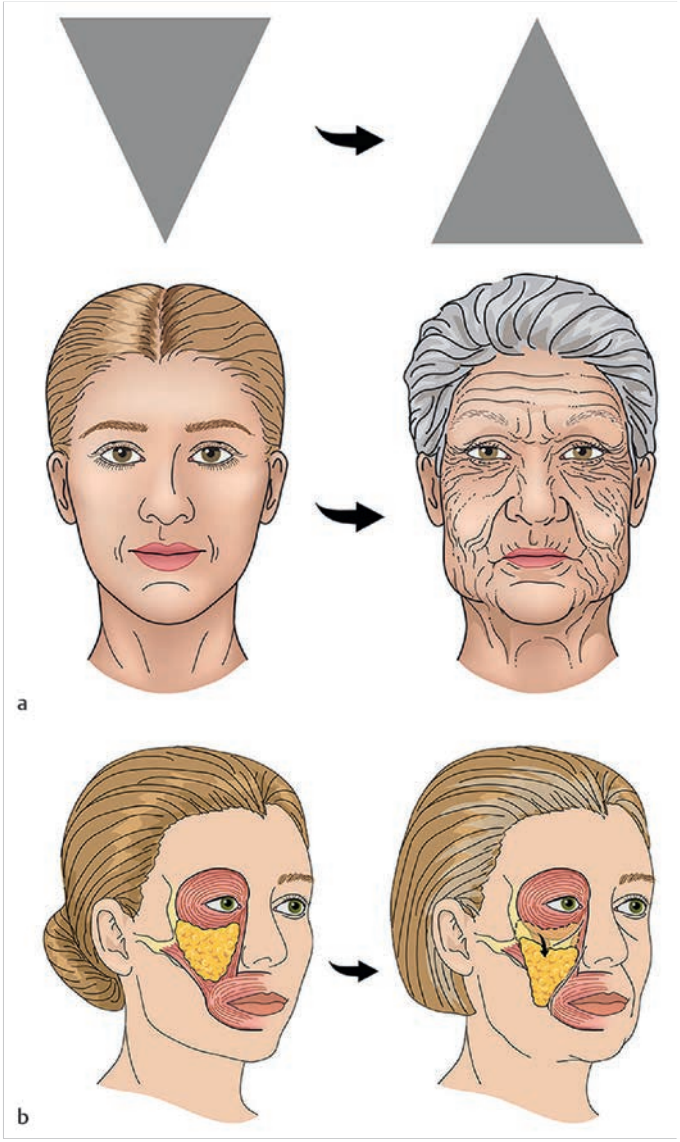

Fig. 2.1 Shift of volume. **(a)** The shape of the prototypical youthful face approximates an isosceles triangle with the point aimed downward near the chin, with a wider top at the temples and cheekbones. As we age, this triangular shape inverts; fat pads underlying the skin descend, nasolabial folds and jowls become more prominent, and tear troughs and temporal hollows deepen. **(b)** Infraocular fat pads descend and rotate medially with age. The nasolabial folds are augmented as the tear troughs under the eyes deepen. (Reproduced with permission from Alam M, Tung R. Injection technique in neurotoxins and fillers: planning and basic technique. J Am Acad Dermatol 2018;79(3):407–419.)

the depth and course of vessels allows practitioners to develop techniques to avoid intravascular injection, vascular injury, and/or compression. The goal in every region is to avoid danger zones that could lead to skin necrosis or visual loss (▶ Table 2.1).

2.2.1 The Upper Face

Muscle movement plays an important part in aging of the upper face. The rhytids in the glabella include the horizontal (procerus muscle) and vertical furrows (corrugator muscle). The horizontal furrows in the forehead are caused by repeated action of the frontalis muscle.[8]

The glabella is the most common site complicated by visual loss as the supratrochlear and supraorbital vessels lie superficial in this region and provide for retrograde flow to the ophthalmic artery (▶ Fig. 2.3).[7,9] Deep wrinkles in the glabellar region or just above the eyebrows can sometimes be targeted by dermal filler. Lower *G*

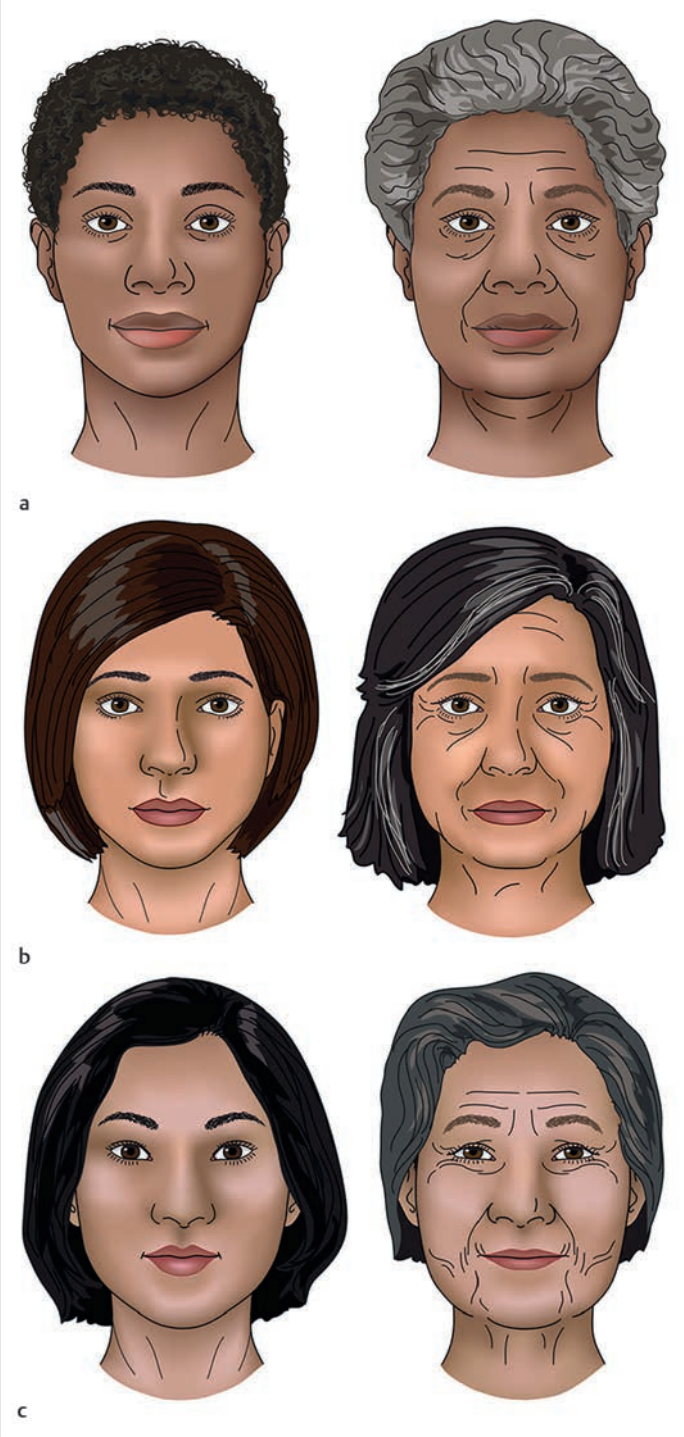

Fig. 2.2 **(a)** Typical African American faces, young and old. **(b)** Typical Latino faces, young and old. **(c)** Typical Asian faces, young and old. (Reproduced with permission from Alam M, Tung R. Injection technique in neurotoxins and fillers: planning and basic technique. J Am Acad Dermatol 2018;79(3):407–419.)

Table 2.1 The most probable locations of arteries in frequently addressed facial regions and the respective anatomical recommendations for the layer of soft tissue filler placement

Facial region	Most probable location of artery	Anatomical recommendation for soft tissue filler placement
Upper forehead	Superficial (layer 2: superficial fat)	Deep (layer 4: supraperiosteal) and intradermal (layer 1)
Lower forehead	Deep (layer 4: supraperiosteal)	Deep (layer 4: supraperiosteal) and intradermal (layer 1)
Temple (superficial)	Superficial (layer 3: superficial temporal fascia)	Superficial (layer 2: superficial fat)
Temple (deep)	Deep (layer 9: supraperiosteal)	Deep (layer 9: supraperiosteal; "one up and one down")
Glabella	Superficial (layer 2: superficial fat)	Deep (layer 4: supraperiosteal) and intradermal (layer 1)
Medial midface	Deep (layer 4: supraperiosteal)	Deep (layer 4†: supraperiosteal; between infraorbital foramen and inferior orbital rim)
Lateral midface	Deep (layer 4: supraperiosteal)	Superficial (layer 2: superficial fat)‡
Dorsum of the nose (midline)	Superficial (layer 2: superficial fat)	Deep (layer 4: supraperiosteal)
Nasolabial sulcus	Superficial (layer 2: superficial fat)	Deep (layer 4: supraperiosteal) and intradermal (layer 1)
Jawline	Deep (layer 4: supraperiosteal)	Superficial (layer 2: superficial fat)‡
Lips	Deep (layer 4: submucosal)	Superficial (layer 2: superficial fat) and intradermal (layer 1)
Chin	Superficial (layer 2: superficial fat)	Deep (layer 4: supraperiosteal)

Notes: Please note that these recommendations are based on anatomy, not on the clinical presentation and the needs of each individual patient; these might require different approaches.
†In the tear trough, only three layers can be identified in total: skin (layer 1), orbicularis oculi muscle (layer 2), and periosteum (layer 3).
‡At the zygomatic arch and at the angle of the mandible, deep injections (in contact with the bone) can be performed.
Source: From Cotofana S, Lachman N. Arteries of the face and their relevance for minimally invasive facial procedures: an anatomical review. Plast Reconstr Surg 2019;143(2):416–426.

products and superficial placement are recommended in this area. The supratrochlear and supraorbital arteries are more superficial, approximately 2 cm above the orbital rim.[7,10,11] Forehead lines 2 cm above the orbital rim can be targeted with fillers injected in a deeper pre-periosteal plane.

Hollowing of the temples that occurs with aging contributes to both a look of senescence and an unhealthy appearance.[8] Re-inflating the temporal fossa with filler can lead to a more youthful or round face; furthermore, it can contribute to a modest elevation of the tail of the brow. The superficial temporal artery lies within the temporoparietal fascia starting at the root of the helix and travelling superficially to above the lateral eyebrow.[12,13] The middle temporal vein lies within the temporal fat pad. The frontal branch of the superficial temporal artery and the middle temporal vein must be avoided. Two injection approaches have been suggested in this area, a deeper preperiosteal and a superficial subdermal injection technique. Carruthers et al suggested an injection

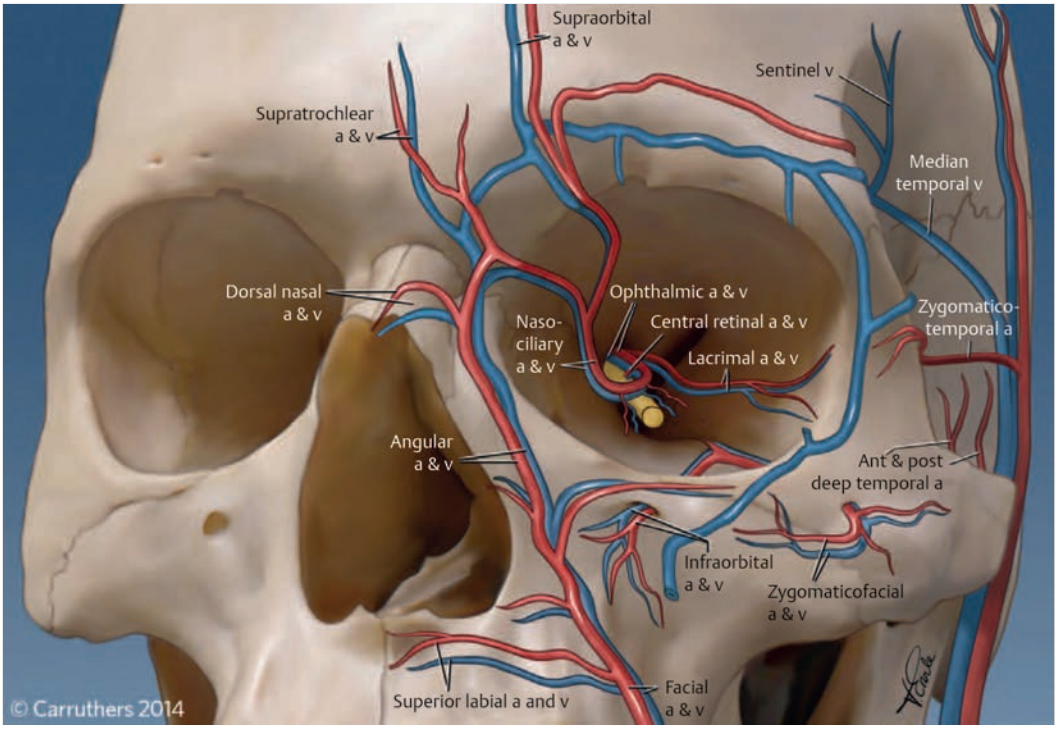

Fig. 2.3 Potential routes for retrograde embolization to the ophthalmic vessels. (Reproduced with permission from Carruthers JD, Fagien S, Rohrich RJ, Weinkle S, Carruthers A. Blindness caused by cosmetic filler injection: a review of cause and therapy. Plast Reconstr Surg 2014;134(6):1197–1201.)

point located 1 cm superior to the tail of the brow along the temporal fusion line and 1 cm inferior to that point.[14]

2.2.2 The Midface

The midface plays an important role in the aesthetics of the aging face.[8] Volumizing this region not only affects the midface proper but also provides a lifting vector to the lower face including the nasolabial folds and to a lesser extent the jowls.

A youthful cheek exhibits a smooth convexity from the lower eyelid to the lower face resembling an ogee curve.[11,15] The bony changes that occur involve an increase in size of the orbits in addition to a decrease in size of the medial maxilla and corresponding expansion of the pyriform aperture.[16] These changes can be explained by a relative clockwise rotation seen between the facial skeleton and the cranium.[17] In addition, there is deflation of the deep fat pads that leads to loss of support and descent of the overlying superficial fat, thereby contributing to the ptotic appearance of the aging face. Augmentation of the cheek region should target the deep medial and lateral malar compartments. One should be mindful of the infraorbital bundle, which lies one finger breadth below the orbital rim at the medial limbus.[18]

In addition to the change in the orbital aperture with aging, the tear trough or naso-jugal deformity is created by the descent of the malar fat pad inferiorly and medially.[19] These changes lead to shadowing in the inferior orbital rim, apparent lengthening of the lower eyelid, and midfacial flattening. Additionally, pseudo-herniation of the lower eyelid periorbital fat can accentuate these changes.[20] Caution must be taken when treating

the tear trough given the thin skin in the area. Injection of a low hydrophilic filler in the suborbicularis oculi plane is advocated to minimize the Tyndall effect and to provide the best cosmetic outcome. Overcorrection of the tear trough should be avoided. Correction of the volume loss in the cheek area can aid in correction of apparent volume loss in the tear trough area.

The nasolabial fold represents a significant danger zone for augmentation related to the facial artery. The facial artery has a tortuous course; the lower two-thirds of the artery travel within the muscle or deep subcutaneous tissue. It is superficial in the upper one-third of the nasolabial fold and connects with the inferior alar and lateral nasal arteries. Thus, injection of fillers is advocated in a pre-periosteal plane, if needed, at the level of the pyriform aperture, and a subdermal plane in the lower two-thirds of the nasolabial folds. Furthermore, injection in the subdermal plane is advocated to occur medial to the fold to avoid exacerbation of the fold.

The nose is a highly vascular region of the face with the vascular structures predominantly lying along the nasal side walls and dorsum including the lateral nasal artery, angular artery, and dorsal nasal artery.[7] The vasculature lies above the superficial musculoaponeurotic system in the subdermal plane.[21] Patients with previous surgical rhinoplasty have increased odds of adverse effects due to surgical changes in anatomy. Injection is advocated in midline in pre-perichondrial or pre-periosteal plane.[22] Caution should be particularly taken when injection of filler is performed in the tip and the ala as they are prone to necrosis secondary to compression injury or vascular injury.[22]

2.2.3 The Lower Face

The upper lip ideally measures one-third of the total vertical distance and the lower lip ideally measures two-thirds. The upper lip should protrude 1 to 2 mm anterior than the lower lip. The superior and inferior labial arteries course deep within the lip, between the orbicularis oris and the mucosa. Injections should be limited to a depth of 3 mm to avoid vasculature.[23]

Chin projection varies between sexes. In males, the chin should be in line with the lower lip. In females, the chin should be 1 to 2 mm behind the lower lip.[24] Augmentation can address mild-to-moderate chin retrusion. Chin augmentation should not extend beyond the medial canthus. The filler should fan laterally to the pre-jowl sulcus for adequate blending.

Youthful jawline creates a curvilinear shadow coursing from the mandibular angle to the anterior chin and is dependent on adequate bony foundation providing sufficient volume at the pre-jowl sulcus and angle of mandible. Volume loss in the melo-labial folds manifests as a shadow anterior to the jowl.[23] The pre-jowl sulcus appears anterior to the jowl as volume loss progresses at the inferior portion of the mandible and is accentuated by increased fullness and descent of the jowls. When filling the pre-jowl sulcus especially in women, it is important to avoid creating a heavy lower face.

The facial artery crosses the body of the mandible at the anterior edge of the masseter muscle in a corkscrew manner.[25] After crossing the mandible, the facial artery enters the buccal space, where it gives off the inferior labial artery and/or the horizontal labio-mental artery, which supplies the chin and the lower lip. The depth of the artery in this location is dependent on the amount of fat in the subcutaneous fat compartments and inside the buccal space. At the modiolus, the artery can be identified in 100% of the cases to be in close proximity to the angle of the mouth, where it is connected to the modiolus by a muscular band emerging from the buccinator muscle. This muscular band attaches the artery in its position 1.5 cm posterior to the corner of the mouth.[7,23] The superior labial artery originates slightly above the inferior labial artery and is covered by the orbicularis oris muscle in its further course. It anastomoses with the superior labial artery of the opposite side and completes the arterial circle around the mouth.[26]

With aging, earlobes become atrophic, develop folds and wrinkles, and may become pendulous.[8] Not only does the ear become less aesthetically pleasing, earrings may not sit well and may become ptotic in position. Occasionally the ear-piercing hole enlarges, which contributes to

malposition of the earring. Filler in the ear lobes improve all the above-mentioned signs of aging.

2.3 Preprocedure Evaluation

A focused medical history should be elicited from patients. Evaluation of patients should include history of allergies, history of complications with soft tissue fillers, prior filler treatments, recent or upcoming dental procedures, existence of an immunocompromised state, autoimmune disease (and how stable if any), dermatologic conditions, recurrent herpes labialis, and current pregnancy or lactation.[27]

Herpes virus reactivation usually appears in the area where the filler has been injected, mostly perioral area and nasolabial folds. However, in some cases, virus reactivation can extend and affect neighboring areas.[28] Virus activation is commonly observed 24 to 48 hours after filler injection.[29] Viral prophylaxis should be recommended to the patients who had recurrent herpes history with 400 mg acyclovir three times per day for 10 days or 1 g valacyclovir twice per day for 7 days.[30]

Medication history should be obtained. The patient may be asked to not take aspirin for at least 8 days, or nonsteroidal anti-inflammatory drugs for at least 5 days, unless discontinuation of these poses a significant risk to the patient. If the patient is on warfarin therapy, the prothrombin time (PT) may be checked; generally, if the PT is under 2.0, then the risk of hematoma or excessive bruising from injection is low.[31] Herbal medications (e.g., *Ginkgo biloba*, St. John's Wort, vitamin E, garlic, ginseng, fish oil) that predispose to bleeding should be held, if possible.[32]

Dental procedures and visits to the oral hygienist are best avoided during the 2- to 4-week period before and after filler treatment to reduce the risk of hematogenous bacterial seeding and potential development of biofilm.[33] Preoperative ingestion of some homeopathic medications (e.g., arnica) may reduce bruising, although further investigation is needed to substantiate this effect.[34] There are very few absolute contraindications to prepackaged injectable fillers. A patient with a known allergy to a specific filler would obviously not be a candidate for the procedure.[31]

2.4 Photography

One key aspect of a successful aesthetic practice is consistent and credible photography. Photographs must have reproducible lighting, standardized poses, and consistent camera angles.[35] Photography is especially important as related to the concept of *"perception drift."*[36] As described by Sola and Fabi, a cosmetic patient can have temporary imbalance in global and local processing after the procedures. After addressing and treating a perceived flaw, we create a change in the appearance that enhances local processing.[36] The previously insignificant or ignored flaws are fixated on and a new "normal" is set. Patients who initially booked a consult to maintain "natural" results no longer look like themselves due to constant pursuit of addressing previously ignored flaws as their baseline morphs over time.[36] To help combat this, we frequently show patients side-by-side photographs of their initial consultation compared with their current photograph. This aids in helping patients focus on enhancing their best features rather than continuously chasing perceived flaws.

2.4.1 Consent

Prior to photography, written informed consent must be obtained from the patient. Consent must state the photographs will become part of the patient's medical record.[37] The consent should also delineate the purpose for which the photographs will be used.[35]

2.4.2 Appearance

The patient's hair should be tucked away in order to avoid obscuring any parts of the face or neck. Often it is ideal to place a patient's hair in a disposable bouffant cap. It is ideal if make up is removed or kept minimal as to be not distracting.[37]

2.4.3 Background

The background should be monochromatic, ideally white, gray, or blue. Background panels can be hung on the backs of doors as a space-saving technique.[37]

2.4.4 Lighting

Consistent overhead lighting is crucial to produce credible photography.[35] It is important to avoid using a camera-mounted flash as this will obscure facial lines, creases, and contours.[35] Finding a location in your examination room where the patient is located equidistant from two overhead fluorescent lights is a practical method of ensuring consistent lighting. Alternatively, an electrician can install a pair of overhanging light emitting diode (LED) panels to ensure adequate lighting.[35]

2.4.5 Positioning

The patient should be seated in a provided chair or stool approximately 1 foot in front of the background panel with hands resting on the knees.[37] It is important to be aware of neck positioning as neck extension or head protrusion can create the illusion of a more defined jawline and reduced submental soft tissue.[38]

The lens should fall at the same height as the patient's nose with the camera about 40 cm from the patient's nose. Five standard views should be taken pretreatment: anterior, right and left oblique views, and right and left lateral views. To obtain consistent oblique views, have the patients turn their entire body 45 degrees to the photographer looking straight ahead.[37]

If filler of the lips is planned, it is important to include photographs of the lips together and relaxed, as well as lips parted at the level with the camera. If vertical lip lines are of concern, taking photographs from above the lips in both relaxed and contracted positions is helpful.[35]

Consistent and credible photography is of extreme importance in development of one's skill as an aesthetic physician, for patient satisfaction, and for growing a successful aesthetic practice.

2.5 Counseling and Setting Expectations

Each patient seeking soft tissue augmentation has unique concerns and the treatment plan should be planned accordingly. The patient's expectations regarding desired outcomes should be met with a frank and honest discussion with the physician.[39] In general, it is often wise to start with hyaluronic acid (HA) volumizers in first-time filler patients as these can be reversed with hyaluronidase.[7] As patients become better acquainted with fillers long-term biostimulators can help patients achieve long-term results.[39]

We caution that prospective patients' intake forms may not be accurate. It is important to take a thorough history prior to proceeding with filler injection. Be sure to review the patient's medication list, whether the patient is pregnant or breastfeeding, has known hypersensitivity to HA or amide anesthetics, or any other known allergies, as well as note any presence of active inflammation including acne or herpes labialis.[27] It is also prudent to determine if the patient has history of autoimmune disease or is immunocompromised as these can place the patient at higher risk for infection.[27] Lastly, ask the patients if they have any history of complications from prior filler procedures.[27]

The patient may be asked to avoid taking aspirin for 8 days prior to the procedure and any nonsteroidal anti-inflammatory drugs for at least 5 days, unless discontinuing places the patient at significant risk. Generally, if a patient is on warfarin and the PT is less than 2.0, the patient is at low risk for hematoma or excessive bruising from the injection.[31]

It is paramount patients understand that no surgical procedure is without risk. Common injection site reactions should be reviewed including redness, swelling, bruising, and tenderness. More serious adverse events should also be reviewed with the patient. These consist of skin necrosis, blindness, stroke, inflammatory events, and nodule formation.[40]

Certain measures can be taken as part of the pre-injection planning process to minimize complications. If possible, avoiding dental procedures, invasive diagnostic procedures, vaccinations, and surgical procedures 2 weeks before and after treatment is recommended to avoid formation of nodules and inflammatory events. We also recommend counseling patients to avoid applying make-up, tap water, or lotions immediately post treatment to avoid nodule formation.[40]

2.6 Aseptic Technique

All make-up should be removed prior to treating the desired sites. Hair should be kept away from the treatment areas with hairbands and/or bouffant cap. Patients should be seated comfortably with a head support, either upright or at an angle. Treatment areas should be prepared with an antiseptic solution such as isopropyl alcohol, chlorhexidine, povidone iodine, or hypochlorous acid.[41]

Chlorhexidine gluconate has a similar antimicrobial spectrum as povidone-iodine but when combined with alcohol has a more rapid onset. Chlorhexidine gluconate binds to the stratum corneum and maintains residual activity in excess of 6 hours, even when wiped from the field. Its action is not affected by the presence of organic matter but it should be used with caution around the eyes as it has been known to cause conjunctivitis and severe corneal ulceration. It may also cause significant ototoxicity if allowed to enter the middle or inner ear through a perforated tympanic membrane.[42]

Povidone-iodine is a broad-spectrum antiseptic with well-known skin-staining and fabric-staining qualities. It works within minutes but must be left on the skin to have a persistent effect. It is quickly inactivated in the presence of blood or sputum, making it a nonideal antiseptic option.[43]

Alcohol-based solutions are rapidly germicidal, but once evaporated it does not have significant residual activity. To address this limitation, alcohol-based preparations are frequently combined with a second agent that has a sustained effect, such as chlorhexidine gluconate. Often the mixture achieves better antisepsis than either agent alone.

More recently hypochlorous acid has been proposed as an option for preprocedure antisepsis. Hypochlorous acid is a naturally occurring, weak acid that is usually released by neutrophils to destroy pathogenic organisms.[44] It has activity against bacterial pathogens including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*, and fungal pathogens such as *Candida albicans* and *Trichophyton mentagrophytes*.[45] Furthermore, it has antiviral properties. Hypochlorous acid is well tolerated and is approved for use on the eyelids for management of blepharitis. Evidence to date is not sufficient however to support the use of hypochlorous acid as the only preprocedural antiseptic preparation.

2.7 Product Selection/ Appropriate Use of Filler

Fat has been used for volume restoration since the late 19th century. In general, it requires an experienced practitioner, more time for extraction and injection, and the patient must have areas of fat deposits to harvest. It can provide excellent results in the nasolabial folds, cheeks, and marionette lines.[31]

The first pre-packaged filler was bovine collagen, known as Zyderm I, Zyderm II, and Zyplast (Allergan, Inc, Irvine, CA). The downsides of bovine collagen are the potential for hypersensitivity requiring skin tests and longevity as it typically lasts 3 to 6 months.[31] Patients who do not experience hypersensitivity reactions on the first injection can still present with such reactions upon subsequent injections. For this reason, repeat testing and monitoring are recommended.[46,47]

The most commonly used human collagen fillers are CosmoDerm 1, CosmoDerm 2, and CosmoPlast (Allergan, Inc), containing purified collagen derived from human fibroblast cell culture lines dispersed in a saline solution with lidocaine. Indications for these products include:

restoration of the lip border and correction of facial wrinkles, acne scars, and soft tissue

contour deformities.[46] Human collagen typically has a shorter-lasting effect compared with bovine collagen fillers. Allergy testing is not required for human collagen.[48]

HA fillers are a considerably newer class of fillers compared with fat and collagen. HA occurs naturally in the body as it is a part of the extracellular matrix. In its natural state HA has a short half-life, which prompted the use of cross linking to increase longevity.[46] Harder, more viscous products are ideal for cheek augmentation and temple restoration. Softer less viscous products are used to improve fine lines and wrinkles, lips, and tear troughs.[49] In less mobile regions of the face, HA

fillers can last 6 to 12 months.[49] Asymmetry or over-injection of HA filler can be dissolved with hyaluronidase.[49]

Poly-L-lactic acid (PLLA) is currently approved by the Food and Drug Administration (FDA) for the correction of shallow to deep nasolabial fold contour deficiencies and other facial wrinkles in immune-competent patients, and for facial lipoatrophy in patients with human immunodeficiency virus (HIV).[50,51] PLLA microspheres stimulate neocollagenesis from fibroblasts, leading to volume correction. The PLLA microspheres themselves are gradually degraded and do not directly contribute to the final result. Three to four sessions every 4 to 6 weeks are needed to achieve final results, which last 18 to 25 months.[51,52] Most providers use PLLA to correct facial wrinkles and volume loss. There is increasing interest in off-the-face application for chest wrinkles, buttock augmentation, knee laxity, and crepiness of the arms.[53]

Calcium hydroxyapatite (CaHA) is FDA-approved medium-term augmentation material for facial wrinkle correction. It is efficacious for the nasolabial folds and marionette lines.[31] Spherules of CaHA are deposited in a neutral gel matrix. After injection, the particles induce a fibroblastic response which stimulates neocollagenesis around the implant to provide sustained aesthetic benefit.[54] Diluted and hyperdiluted CaHA is being increasingly used off the face for skin tightening and to improve skin quality.[55]

A filler approved by the FDA that may have some degree of permanent persistence is polymethylmethacrylate (PMMA).[56] PMMA was approved for use in the United States in 2006. It consists of 20% PMMA microspheres of 30 to 50 µm in diameter suspended in 3.5% bovine collagen and 0.3% lidocaine.[49] It does require skin testing prior to treatment due to risk of bovine hypersensitivity. After 1 month of injection, the carrier is resorbed and fibrosis occurs around the polymer bead.[49] A 5-year cohort study noted a granuloma incidence of 1.7%; half of these resolved by the end of the study.[56] Some providers feel granuloma incidence is underreported and thus are less inclined to use PMMA.

Silicone is a permanent filler that has been used for several decades. There are many reports of granulomas, foreign body reactions, and extrusion. Many of these cases have been related to product impurities and/or bolus injections.[31] Using the microdroplet technique, silicone has been shown to improve acne scars without complications.[57]

2.8 Conclusion

With the rise in popularity of filler injections, there are increased risks for adverse events. It is key to remember pre-injection planning is equally as important as the injection itself. Keeping in mind the patient's unique anatomical features, taking a thorough history, reviewing common and rare side effects, documenting with consistent and credible photography, along with choosing the appropriate filler are important steps in helping patients achieve their aesthetic goals and in avoiding adverse events.

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