COSMETIC

Consensus Recommendations for Optimal Augmentation of the Asian Face with Hyaluronic Acid and Calcium Hydroxylapatite Fillers

Nark-Kyoung Rho, M.D. Yao-Yuan Chang, M.D. Yates Yen-Yu Chao, M.D. Nobutaka Furuyama, M.D. Peter Y. C. Huang, M.D. Martina Kerscher, M.D. Hee-Jin Kim, D.D.S. Je-Young Park, M.D. Hsien Li Peter Peng, M.D. Paisal Rummaneethorn, M.D. Berthold Rzany, M.D., Sc.M. Hema Sundaram, M.D. Chin Ho Wong, M.D. Yuli Yang, M.D.

Adri Dwi Prasetyo, M.D. Seoul, Republic of Korea; Taipei and

Kaohsiung, Taiwan; Tokyo, Japan; Hamburg and Berlin, Germany; Bangkok, Thailand; Rockville, Md.; Singapore; and Surabaya, Indonesia



Background: Although the use of filling agents for soft-tissue augmentation has increased worldwide, most consensus statements do not distinguish between ethnic populations. There are, however, significant differences between Caucasian and Asian faces, reflecting not only cultural disparities, but also distinctive treatment goals. Unlike aesthetic patients in the West, who usually seek to improve the signs of aging, Asian patients are younger and request a broader range of indications.

Methods: Members of the Asia-Pacific Consensus group—comprising specialists from the fields of dermatology, plastic surgery, anatomy, and clinical epidemiology—convened to develop consensus recommendations for Asians based on their own experience using cohesive polydensified matrix, hyaluronic acid, and calcium hydroxylapatite fillers.

Results: The Asian face demonstrates differences in facial structure and cosmetic ideals. Improving the forward projection of the "T zone" (i.e., forehead, nose, cheeks, and chin) forms the basis of a safe and effective panfacial approach to the Asian face. Successful augmentation may be achieved with both (1) high- and low-viscosity cohesive polydensified matrix/hyaluronic acid and (2) calcium hydroxylapatite for most indications, although some constraints apply.

Conclusion: The Asia-Pacific Consensus recommendations are the first developed specifically for the use of fillers in Asian populations. (*Plast. Reconstr. Surg.* 136: 940, 2015.)

CLINCIAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, V.

Soft-tissue augmentation with injectable fillers has become an indispensable aspect of aesthetic medicine worldwide. However, most clinical trials and consensus publications predominantly feature older Caucasian individuals attempting to ameliorate age-related changes in the face. By contrast, augmentation in Asia focuses on facial shaping and contouring in a

From the Leaders Clinic, Yonsei University, Oracle Derm Clinic; Yes Clinic, L1 Cosmetic Surgery and Laser Center, Rebecca Cosmetic Center, P-Skin Professional Clinic, and Med Aesthetic Clinic; Jiyugaoka Clinic; University of Hamburg and Rzany & Hund; Pinklao Clinic; Sundaram Dermatology, Cosmetic & Laser Surgery; W Aesthetic Plastic Surgery; and Rejuva Skin & Beauty.

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significantly younger population (Fig. 1).¹ Aside from recent guidelines for the clinical application of neurotoxins in Asians,² no guidelines for the use of cosmetic fillers in the same population have been published. This article presents consensus recommendations for two of the most popular injectable filling agents on the market hyaluronic acid and calcium hydroxylapatite—for facial augmentation in Asians.

MATERIALS AND METHODS

The Asia-Pacific Consensus group comprises 13 experts in the fields of dermatology and plastic surgery, and one expert each from anatomy and clinical epidemiology. Members have used hyaluronic acid for an average of 10 years (range, 5 to 15 years) and calcium hydroxylapatite for an average of 5 years (range, 0 to 10 years). In July of 2014, consensus members gathered for a fullday meeting in Hong Kong to develop consensusbased recommendations for the use of hyaluronic acid and calcium hydroxylapatite in Asian populations. A consensus was defined as approval from 75 to 95 percent of all participants, and agreement of greater than or equal to 95 percent denoted a strong consensus (indicated by asterisks). Statements are presented as "recommended" (strong recommendation) or "suggested" (weaker recommendation) following the grades of recommendation, assessment, development, and evaluation.³ A majority vote did not mean that all consensus members agreed with the statement, and some experts supported different views on certain subjects. However, it was not the purpose of this study to reflect all possible views on a specific topic but to present a consensus on best current practice recommendations.

PROPERTIES OF FILLING AGENTS

These recommendations focus on the use of low- to high-viscosity cohesive polydensified matrix hyaluronic acid (Belotero; Merz Pharmaceuticals GmbH, Frankfurt, Germany) and calcium hydroxylapatite (Radiesse; Merz Pharmaceuticals GmbH). Viscosity and elasticity, which are measure of gel stiffness, are believed to influence filler suitability for particular procedures.⁴ In general, the greater the viscosity, the deeper the filler should be injected. Fillers with low viscoelasticity are lighter and tend to spread more, whereas



Fig. 1. Some Asian patients desire substantial alterations to facial contours. Patient before (*left*) and 1 month after (*right*) injections of 1.5 ml of calcium hydroxylapatite prediluted with 0.5 ml of lidocaine in the central forehead (0.8 ml), glabella (0.4 ml), lateral forehead (0.6 ml per side), supraorbital region (0.2 ml per side), cheek bone (0.3 ml per side), medial cheek (0.6 ml per side), nose (0.8 ml), and chin and jawline (1.8 ml), along with concomitant treatment of the masseter muscles with botulinum toxin. (Courtesy of Yates Yen-Yu Chao, M.D.)

those with high viscoelasticity provide more lift and stay put after implantation.^{4,5}

The group of hyaluronic acid fillers discussed here use cohesive polydensified matrix technology and dynamic cross-linking to achieve a monophasic, polydensified, cohesive gel appropriate for superficial to deep implantation, depending on the chosen viscoelastic properties⁶ (Table 1). Clinical trials have shown cohesive polydensified matrix/hyaluronic acid to be superior to collagen injection in the treatment of nasolabial folds,^{7,8} with efficacy and safety similar to other hyaluronic acid fillers and a duration of up to 12 months.^{9,10} Cohesive polydensified matrix/hyaluronic acid formulations are available with and without lidocaine in many countries.

Calcium hydroxylapatite microspheres consist of smooth, biodegradable, highly biocompatible particles derived from the main component found in bone that induces neocollagenesis, leading to long-lasting cosmetic correction of approximately 15 months or longer when treating nasolabial folds.^{11,12} Implantation of calcium hydroxylapatite results in active, physiologic remodeling of the extracellular matrix-indicated by increased elastin and the gradual replacement of collagen type III by collagen type I—leading to long-term deposition of new collagen around the microspheres.^{13–15} With its high level of viscoelasticity, calcium hydroxylapatite is well suited for supraperiosteal, subdermal, and deep-dermal placement. In situ addition of lidocaine results in significant pain reduction without compromising aesthetic improvement.^{16,17} Calcium hydroxylapatite is not indicated in the lips, tear trough, or glabella, or for superficial injection because of the incidence of nodule formation.¹⁸

Volumes and Dosing

Volumes discussed in these recommendations refer to cohesive polydensified matrix/hyaluronic

acid formulations and are approximate. For most applications, a lower volume of calcium hydroxyl-apatite will be required to provide the same degree of correction as referenced hyaluronic acid.¹¹ All doses may be adjusted according to individual features and user preference.

THE ASIAN FACE

Although making broad assumptions about any given ethnic or racial group can be problematic within all generalizations lie variations, exceptions, and regional differences—certain comparisons can be noted between Asians and Caucasians. The Asian face is rounder, wider, and flatter in the anterior midface projection than its Western counterpart.¹⁹ The forehead does not project, the nose is smaller and wider and has a bulbous and poorly projected tip, the chin lacks distinction, and the mandible is large and sometimes bulky.²

Patterns of Aging

Asian skin is usually thicker and darker, and the underlying soft tissues and pockets of fat are more dense and able to hold their shape longer.^{20,21} Because of these differences, Asians appear to age more slowly, without early laxity or fine wrinkling.²²

Perceptions of Beauty

The typical Asian cosmetic patient often wishes to modify features and facial contours deemed less attractive. Structural augmentation should improve aesthetic appearance without distorting ethnic identity. Trends of filler treatment in Asia display many variations, and what is popular in one region may be unacceptable in another.²³ Because Asians generally have broad and flat faces, augmentation of the T zone—the forehead, nose, medial cheeks, and chin—is the fundamental backbone of a threedimensional profile (Fig. 2).

 Table 1. Properties of Cohesive Polydensified Matrix/Hyaluronic Acid Formulations and Calcium

 Hydroxylapatite

	Belotero Soft	Belotero Balance/ Basic	Belotero Intense	Belotero Volume	Radiesse
Ingredients	20 mg/ml HA	22.5 mg/ml HA	25.5 mg/ml HA	26 mg/ml HA	CaHA particles (30%); gel carrier (70%)
Uses	Superficial lines	Medium to deep lines; lip enhancement	Deep lines; volume and lip augmentation	Improvement of facial volume loss	Deep lines; facial sculpting; lifting and contouring
Cohesivity level	++++	++++	+++	++	Ň/A
Elasticity level	+	++	+++	++++	+++++
Viscosity level	+	++	+++	++++	+++++

HA, hyaluronic acid; CaHA, calcium hydroxylapatite.

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Fig. 2. Patient before (*left*) and after (*right*) panfacial augmentation with three syringes of calcium hydroxylapatite into the chin, jaw, nose, cheeks, zygoma, supraorbital ridge, and medial brow, and botulinum toxin treatment for masseteric hypertrophy. (Courtesy of Yates Yen-Yu Chao, M.D.)

FOREHEAD AUGMENTATION AND REJUVENATION

Augmentation is critical in enhancing the forward projection of the Asian forehead (Fig. 3 and Table 2) and often improves the appearance of fine lines and skin contours without further need for skin rejuvenation (Fig. 4). Rejuvenation of the forehead skin—decreasing the appearance of wrinkles and folds—is requested less frequently in Asians compared with Caucasians. The consensus group recommends forehead augmentation, if required, before skin rejuvenation, along with pretreatment with neurotoxins, tailoring doses to individual needs.



Fig. 3. Injection sites for augmentation of the forehead.

Anatomical Considerations

Too much product placed inappropriately will lead to suboptimal results and irregularities, especially in the lateral forehead and in patients with thinner skin. More importantly, the utmost care must be taken to avoid the supraorbital and supratrochlear arteries and the frontal branch of the superficial temporal artery when injecting fillers into the glabella and central brow (Fig. 5).

TEMPLE CONTOURING

The temples are subject to dramatic changes over time.^{24,25} Filling this area in the younger Asian patient serves to shape the temple in conjunction with forehead augmentation (Fig. 6 and Table 3). For rejuvenation in patients with aging changes of the bony frame, more emphasis should be placed in the lateral brow area.

Anatomical Considerations

There are two main anatomical structures to avoid when injecting in the temple—the superficial temporal arteries and veins, and the frontal branch of the facial nerve, both of which can be found along the deep surface of the superficial temporal fascia, although there is some anatomical variation.^{26,27} The supraperiosteal level is the safest plane for injection in the temples.

TEAR TROUGH AUGMENTATION

Aging of the lower lid and cheek results in bulging of orbital fat and deepening of the orbital

	Augmentation	Rejuvenation
Product	High-viscosity HA* or CaHA when used with caution	Low-viscosity HA*
Volume	1–1.5 ml (mild), 2–2.5 ml (moderate), or 3–4 ml (severe)*	~0.25–1 ml, depending on degree of severity*
Technique	Cannula [*] ; two lateral points just above the eyebrows [*] ; fanning and/or linear threading [*] ; avoid medial injec- tions [*] ; central entry points may be considered by advanced injectors [*]	Augmentation before rejuvenation, if needed*; needle or fine cannula*; pretreat with neuro- toxin*
Injection plane	Supraperiosteal*	Subdermal or dermal*

Table 2. Recommendations for Forehead Augmentation and Rejuvenation

HA, hyaluronic acid; CaHA, calcium hydroxylapatite. *Strong consensus.

rim groove, known as the "tear trough" (Fig. 7 and Table 4). Midface augmentation often improves the appearance of the tear trough and is recommended as the first step in a panfacial treatment approach; overfilling the area often disrupts the lid-cheek junction, resulting in a more unnatural appearance.

Anatomical Considerations

The tear trough is the superior aspect or extension of the nasojugal fold. The orbicularis oculi attaches directly to bone along the tear trough; along the lid-cheek junction, the attachment is ligamentous by means of the orbicularis retaining ligament.²⁸ The inferior orbital fat compartment is analogous to the sub–orbicularis oculi fat below the orbital septum. Removal of excessive fat by blepharoplasty is indicated in some cases before augmentation.

Augmentation of the tear trough allows little room for error; thin skin directly overlying thin orbicularis oculi muscle and bone easily shows irregularities and is prone to bruising or discoloration. Moreover, the terminal branch of the facial artery (the angular artery) runs along the nasojugal groove and is vulnerable to injury by superficial injection.²⁹ The use of calcium hydroxylapatite is not recommended for augmentation of the tear trough.

MIDFACIAL AUGMENTATION

Asian faces are typically wider, shorter, and flatter than Western faces, and this central concavity represents one of the most common complaints among Asian patients. Deep augmentation of the cheek can result in profound changes in all areas of the mid and lower face (Fig. 8) and is recommended before augmenting the tear trough or nose, correcting nasolabial folds, or filling the perioral region.¹¹

Anatomical Considerations

The cheek can be divided into the zygoma, the medial cheek, and the submalar region, defined medially by the nasolabial folds, superiorly by



Fig. 4. Patient before (*left*) and after (*right*) 3 ml of calcium hydroxylapatite in the fore-head. (Courtesy of Hsien Li Peter Peng, M.D.)

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Fig. 5. Arteries of the face. (Reprinted with permission from Radlanski RJ. The Face. Berlin: Quintessenz Publishing; 2012:39.)

the malar eminence, and laterally by the anterior border of the masseter.³⁰ Restoring the three anatomically distinct superficial fat compartments in the cheek—the medial, middle, and lateral temporal cheek fat—improves volume loss under the eyes, helps reduce prominent lines and folds around the nose and mouth, and gives more curve to the upper lip (Fig. 9 and Table 5).³⁰

The zygoma or malar eminence represents the maximal projection of the cheek. In many Asian populations, lateral augmentation of the zygoma—considered a masculine feature—is neither necessary nor appreciated; a more rounded "apple" cheek without zygomatic emphasis is preferred. Augmentation aims to restore anterior projection, targeting the medial aspect of the zygoma and submalar regions to smooth the upper and lower contours of the cheek (Figs. 10 and 11 and Tables 6 and 7).

NONSURGICAL RHINOPLASTY

The Asian nose is characterized by a low, broad dorsum; short nasal bones; a round,



Fig. 6. Injection sites for augmentation of the temples.

underprojected and underrotated tip; and thick skin.³¹ The bridge of the nose sits low, with an acute nasolabial angle. Nonsurgical rhinoplasty is one of the most popular procedures among Asians. Augmentation is indicated for the correction of low nasal bridges or slight nasal hump, and/or supratip volume deficiency (Fig. 12 and Table 8).

The tip is not easily augmented because of the presence of rounded, soft cartilage under a thick layer of skin.³¹ Careful palpation will assess skin thickness, elasticity, and strength of the cartilage; the size and position of the nasal bones; and the presence of bony stepoffs. The consensus group does not suggest routine treatment of the columella but suggests that additional filler into the nasal spine adds support to the tip without altering its position in certain cases.

Anatomical Considerations

The nose is one of the most challenging areas to inject and requires extreme caution. The ophthalmic and facial arteries supply blood to the external nose, with the dorsum supplied by the lateral nasal artery and dorsal nasal artery (Fig. 6). Vigilance must be taken to avoid inadvertent intravascular injection, which can lead to ischemia and subsequent tissue necrosis or, in rare cases, blindness.³²

NASOLABIAL FOLDS AND MAXILLA ADVANCEMENT

Nasolabial folds are exacerbated as the malar and medial cheek fat pads shrink and the cheek falls. Replacing volume in the midface lifts the cheeks and naturally improves the appearance of the folds, but deeper grooves require more attention. In Asian patients, fillers in the nasolabial area not only fill deep folds, but are also used to increase the forward projection of the upper maxilla, adding support to a depressed midface (Fig. 13 and Table 9).

Anatomical Considerations

The facial artery ascending along the nasolabial fold is particularly vulnerable to vascular injury by superficial injection (Fig. 5). Slow, deep injections are strongly recommended.

CHIN AND JAWLINE

The chin (Fig. 14 and Table 10) and jawline (Fig. 15 and Table 11) may be considered a single unit, in which augmentation of one affects the other. The chin and jaw are subject to regional variance influenced by media and trends. Most Asian women desire an inverted triangle shape to the face, with a slender chin and jaw, but some younger women favor a more pointed, "elfin" chin. The Asian mandible is wider and more pronounced than Western jawlines, and there is great demand for masseter contouring in conjunction with the chin, especially among women. The aesthetics of the jawline vary according to gender in Asia: the strong, wide mandible is considered masculine, whereas the ideal feminine jaw is narrow and slender. Communication between

	Recommendations
Product	High-viscosity HA* or CaHA
Volume	1.5–2 ml per side; up to 3 ml for more severe cases*; small aliquots (0.5 ml) per injection point; large boluses increase the risk of side effects*
Technique	
Needle*	2–4 injection points per side*; deep vertical depot injection*
Cannula*	Entry between junction of the temple and zygoma, close to the hairline*; fanning*
Injection plane	Supraperiosteal (needle) or subdermal to supraperiosteal (cannula)*
HA hyaluronic acid: CaHA calcium hydroxylapatite	

Table 3. Recommendations for Temple Contouring

HA, hyaluronic acid; CaHA, calcium hydroxylapatite. *Strong consensus.

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Fig. 7. Injection sites for augmentation of the tear trough.

physician and patient about desired aesthetic shape of the jaw and chin is crucial.

Anatomical Considerations

The mental area should be addressed for a complete synthesis of the Asian face; augmentation of the chin can improve its shape and forward projection, creating a more tapered appearance and changing the contours of the lower face. Although projection of the menton and pogonion is easier to achieve using needles, the injector must be aware of a number of smaller blood vessels near the apex of the chin, which are associated with frequent bruising. Fillers may be visible with contraction of the mentalis muscle if implanted too superficially, whereas overcorrection in the bony inferior aspect can lead to an unnatural appearance.

Over time, bone loss, weakening of ligaments, and soft-tissue atrophy give rise to the prejowl sulcus and the formation of jowls. Shaping the jawline involves augmentation from the posterior edge of the premasseter space to the anterior edge of the prejowl sulcus; augmentation without consideration of the anterior and posterior borders of the jowl will likely enhance its appearance and interrupt the smooth line of the jaw. Areas of concern in the jaw include the possibility of lumps after subdermal placement, and the preperiosteal location of the facial artery and vein (Fig. 4).

PERIORAL AUGMENTATION

The perioral region readily reveals the signs of aging: lips begin to deflate and flatten, and oral commissures turn down, emphasizing the sagging mouth and prominence of the marionette lines. Although lip augmentation is popular in the West, Asians typically have thicker upper lips and wish to avoid an unnatural, overcorrected appearance, with an upper-to-lower lip ratio of 1:1.2.33 Small amounts of filler into the vermilion border provide definition and contour to the lip line, and injections into the body of the lip subtly add volume and pleasing proportion to the upper and lower lips (Fig. 16 and Table 12). Younger individuals usually only require augmentation of the central lip, with additional vermilion definition and enhancement of the philtral columns, whereas older patients will need augmentation along the entire length of the lip and added volume in the vermilion to ameliorate small, vertical lip rhytides.34

Augmentation of the marionette lines (Fig. 17 and Table 13) is often performed in conjunction with treatment of the prejowl sulcus. The lines can be difficult to eradicate completely; in those cases, a layering approach with high- and low-viscosity fillers may be of benefit.

Anatomical Considerations

The mouth is an unforgiving area for augmentation and requires a conservative approach with appropriate filling agents. The orbicularis oris inserts into the mucous membrane of the lips and is innervated by the buccal and mandibular branches of the facial nerve, and the vermilion features extensive superficial vasculature. Because

	Recommendations
Product	Low-viscosity HA*
Volume	Up to 0.5 ml per side*
Technique	
Needle*	A sharp, narrow-gauge needle allows for more control*; 2–4 injections along the tear trough*
Cannula	Blunt cannulas may avoid bruising; midcheek entry on the nasojugal groove
Injection plane	Deep supraperiosteal plane*; in patients with more severe signs of aging, consider adding small amounts of HA in the very superficial plane to taper the lid-cheek junction
HA, hyaluronic acid.	
*Strong consensus.	



Fig. 8. Patient before (*left*) and 2 weeks after (*right*) anteromedial cheek augmentation using high-viscosity hyaluronic acid (1 ml per side). (Courtesy of Nark-Kyoung Rho, M.D.)



Fig. 9. Injection sites for augmentation of the anteromedial cheek.

dynamic musculature and movement may lead to product beading and nodule formation with particulate fillers, the use of calcium hydroxylapatite is contraindicated in the lips.

RESTORATIVE EFFECTS OF SOFT-TISSUE FILLERS

Progressive reduction of hyaluronic acid within the dermal matrix has been proposed as the cause of the most striking age-related changes in the skin.^{35,36} Injecting small aliquots

Table 5. Recommendations for Augmentation of theAnteromedial Cheek

	Recommendations
Product Volume	High-viscosity HA* or CaHA* 0.3–1.5 ml per side*
Technique Needle	Insertion into SOOF over zvgoma
Cannula	Lateral entry
Injection plane	Deep supraperiosteal plane for CaHA*; combination supraperi- osteal and subdermal for HA*

HA, hyaluronic acid; CaHA, calcium hydroxylapatite; SOOF, suborbicularis oculi fat. *Strong consensus.

of hyaluronic acid into large areas of the dermis (e.g., covering both cheeks, the entire face, neck, or décolletage in intervals of 2 to 6 weeks over three treatment sessions) has been shown to gradually improve cutaneous hydration, leading to enhanced skin turgor and firmness,³⁷⁻³⁹ improvement in skin surface roughness and elasticity,³⁷⁻⁴⁰ and neosynthesis of collagen.^{37-39,41-43} Small amounts of gel are administered using micropuncture semirandom technique а (Table 14). Initially, two or three treatment sessions in a 4-week interval are usually required for maximal improvement, with a maintenance schedule of one session every 4 to 6 months recommended for sustained improvement in skin quality.³⁹ Approximately 75 percent of consensus members regularly treat the face and neck with intradermal hyaluronic acid injections.



Fig. 10. Injection sites for augmentation of the mid-zygoma area.



Fig. 11. Injection sites for submalar contouring.

HAND AUGMENTATION

Many factors contribute to the structural signs of aging in the hands, including sun exposure, friction, and extreme temperatures, and biological changes to soft tissues and bones.⁴⁴ Augmentation with fillers addresses the increasing visibility of underlying bones, tendons, and veins as the dermis thins (Fig. 18 and Table 15).⁴⁴ Calcium hydroxylapatite has been shown to be safe and effective for hand rejuvenation, with a high level of patient satisfaction and a longer duration than hyaluronic acid (12 to 24 months versus 6 to 9 months).^{45,46} The filler is injected into the dorsum of the hands.⁴⁵ After tenting the skin, injections are typically delivered through a needle by means

Table 6. Recommendations for Augmentation of theMid-Zygoma Area

	Recommendations
Product	High-viscosity HA* or CaHA*
Volume	0.25–1 ml per side*
Technique	1
Needle*	Just medial to the malar eminence*; vertical depot*
Cannula*	Entry more medial and inferior to needle insertion*; linear threading or fanning*
Injection plane	Deep supraperiosteal*
HA, hyaluronic acid	; CaHA, calcium hydroxylapatite.

*Strong consensus.

Table 7. Recommendations for Submalar Contouring

	Recommendations
Product	High-viscosity HA* or CaHA*
Volume	0.5–2 ml per side*
Technique	1
Needle*	Multiple puncture*
Cannula*	Fanning*
Injection plane	Subdermal*

HA, hyaluronic acid; CaHA, calcium hydroxylapatite. *Strong consensus.



Fig. 12. Injection sites for nonsurgical rhinoplasty.

of a bolus into the space created between the subcutaneous layer and superficial fascia between the central tendons.⁴⁵ Several entry points may be used for the cannula.

Anatomical Considerations

There are three distinct fatty laminae (superficial, intermediate, and deep) divided by thin fascia on the dorsum of the hand.⁴⁷ The large dorsal veins and nerves are located within the intermediate lamina, whereas the tendons are located in the deep

Table 8. Recommendations for NonsurgicalRhinoplasty

	Recommendations
Product	High-viscosity HA* or CaHA
Volume	0.5–1.3 ml*
Technique†	
Needle	Serial puncture along dorsum; routine treatment of the columella is not suggested
Cannula*	Entry into infratip lobule of the nasal tip*; linear threading*; routine treat- ment of the columella is not suggested
Injection plane	Supraperiosteal with or without supraperichondrial*

HA, hyaluronic acid; CaHA, calcium hydroxylapatite. *Strong consensus.

†Using slow, low-pressure injections with small amounts of filler (0.2 ml per depot) and avoiding injections near the angular artery are advised. Applying digital pressure over the artery while injecting the dorsum of the nose may help prevent migration into the vessels.



Fig. 13. Injection sites for augmentation of the nasolabial folds.

lamina. Injection into the hand may be painful and requires the use of topical anesthetic before treatment and/or the addition of lidocaine to the filler.⁴⁸

AVOIDANCE AND MANAGEMENT OF COMPLICATIONS

All fillers are associated with early, injectionrelated side effects such as mild pain, erythema, and edema.^{7,49} More severe reactions are fortunately rare but do occur, and may be divided into those that occur early after implantation and those that can appear weeks to years after treatment.⁵⁰ Treatment recommendations for these complications focus on both prevention and management (Table 16).

Table 9. Recommendations for Augmentation of theNasolabial Folds

	Recommendations
Product	High-viscosity HA* or CaHA*
Volume	0.5–1 ml per side*
Technique	1
Maxilla advancement†	Sharp needle directly on bone*; vertical depot*; slow injection*
Fold correction [†]	Usually cannula*; fanning*; slow injection*
Injection plane	5
Maxilla advancement	Deep supraperiosteal*
Fold correction	Subdermal layer*

HA, hyaluronic acid; CaHA, calcium hydroxylapatite.

*Strong consensus.

[†]Combine both techniques for correction of *moderate to severe folds.



Fig. 14. Injection sites for augmentation of the chin.

Table 10. Recommendations for Augmentation ofthe Chin

	Recommendations
Product	High-viscosity HA* or CaHA*
Volume	1–3 ml*
Technique [†]	
Needle*	Insertion at three points; vertical depot; three-point needle technique with CaHA for patients requesting more pointed "elfin" chin
Cannula*	Entry into apex of chin*; fanning*
Injection plane	Supraperiosteal and subdermal*
HA, hyaluronic acid; *Strong consensus.	CaHA, calcium hydroxylapatite.

†Use neurotoxins in combination with *fillers.

Noninflammatory Nodules

Subcutaneous noninflammatory nodules present early as palpable and/or visible bumps under the skin and are usually caused by poor technique or choice of filler. Over 80 percent of consensus



Fig. 15. Injection sites for augmentation of the jaw.

Table 11. Recommendations for Jaw Contouring

	Recommendations
Product	High-viscosity HA* or CaHA*
Volume	0.5–2 ml per side*
Technique	1
Needle*	Insertion in the prejowl sulcus and posterior mandible; multipuncture; linear threading or vertical depot
Cannula*	Entry into prejowl sulcus and posterior mandible*; linear threading or fanning*
Injection plane	Supraperiosteal and subdermal*; con- sider the differences between male and female shape of the jawline in different Asian populations*

HA, hyaluronic acid; CaHA, calcium hydroxylapatite. *Strong consensus.

members reported experience with overcorrection or too-superficial depots of hyaluronic acid or calcium hydroxylapatite. Highly mobile areas, such as the lips or above the orbital rim, are more at risk for nodule formation caused by accumulation of material from repetitive muscular movement. Noninflammatory nodules usually respond to vigorous massage, with or without needle disruption with saline or lidocaine.⁵¹ Hyaluronidase will enzymatically digest unwanted depots of hyaluronic acid filler.⁵² In the case of overcorrection with calcium hydroxylapatite, dilution with saline and/or lidocaine is recommended for careful redistribution of the material.

Vascular Compromise

Vascular events are very rare but serious complications attributed to intravascular injection of filler material and subsequent occlusion, leading to



Fig. 16. Injection sites for lip contouring and augmentation.

tissue necrosis of the skin and subcutaneous tissue, and blindness. Areas of risk include the nose and nasolabial folds, the glabella, and the forehead.

Nonocular ischemic events are characterized by intense pain, skin blanching, and discoloration.⁵³ Slow injections with minimal pressure and the use of larger cannulas may reduce the risk of embolization. Because of anatomical variation, it is not always possible to avoid vascular events, even with a thorough knowledge of facial anatomy. Immediate discontinuation of the treatment followed by appropriate management techniques aimed at increasing blood flow to affected areas—by decreasing pressure within the anatomical compartment, dilation of blood vessels, or increasing oxygen content to the affected tissues—is recommended.⁵⁴

The management of ocular occlusion is more problematic; prevention is critical. Inadvertent injection into the terminal branch or proximal branches of the ophthalmic artery causes instant simultaneous excruciating ocular pain and usually irreversible blindness^{55–61} unless retinal circulation is restored within 60 to 90 minutes.⁶² In theory, retrobulbar injection of a large volume of hyaluronidase—which has been used to clear intraocular vitreous hemorrhage⁶³—may dissolve the intraorbital hyaluronan, dramatically reducing intraocular pressure and helping prevent otherwise certain partial or often complete loss of vision.⁶¹

Inflammatory Nodules

Contamination during filler procedures is always a risk. Infection should be suspected in cases of early abscesses and inflammatory nodule formation.

	Contouring	Augmentation
Product	Low-viscosity HA	High-viscosity HA*
Volume	0.5–1.0 ml	0.5–1.0 ml
Technique		
Needle	Entry at lateral edge of lip and tunneled to midpoint along vermilion border; retrograde linear threading	Multiple injection points along the junction of the wet-dry border
Cannula	0 0 0	Entry at lateral corner of the mouth
Injection plane	Subdermal and submucosal	Subdermal and submucosal
HA hvaluroni	c acid	

Table 12. Recommendations for Lip Contouring and Augmentation

HA, hyaluronic acid.

*Strong consensus.



Fig. 17. Injection sites for augmentation of the marionette lines.

Table 13. Recommendations for Augmentation ofthe Marionette Lines

	Recommendations	
Product	High-viscosity HA or CaHA	
Volume	0.25–1.0 ml per side	
Technique	1	
Needle	Two or more entry points; vertical depot or linear threading	
Cannula	One entry point; fanning	
Injection plane	Subdermal (HA) or supraperiosteal and subdermal (HA, CaHA)	

HA, hyaluronic acid; CaHA, calcium hydroxylapatite.

However, the majority of late-onset complications are immune-mediated in nature and not well understood.^{18,64} In general, all fillers are capable of stimulating a foreign-body reaction, which results in the formation of mature fibrous tissue around the implant.¹⁸ Some of these reactions may indicate the presence of a biofilm—quiescent infection by bacteria leading to the formation of a densely packed community of microorganisms encapsulated by a protective matrix that allows them to irreversibly adhere to living or inert surfaces.⁵¹

Table 14. Recommendations for the Use ofRestorative Intradermal Fillers

	Recommendations	
Product	Low-viscosity HA	
Volume	Small, singlé aliquots (0.02–0.04 ml),	
	from totals of 1 ml (mild) to 2 ml	
	(severe) in the face and 0.3 ml (mild)	
	to 2 ml (severe) in the neck per session	
Technique	Fine needle; serial punctures in the face,	
Â	neck, and décolletage	
Injection plane	Intradermal and subdermal	
HA, hvaluronic acid.		



Fig. 18. Injection sites for hand augmentation.

Hyaluronic acid–based fillers are not typically associated with many long-term side effects. Although delayed nodule formation and hypersensitivity reactions have been reported,^{65,66} a long-term safety analysis of cohesive polydensified matrix/hyaluronic acid reveals no persistent nodules or reports of granulomas.⁶ There have been no confirmed reports of granuloma in clinical studies of up to 30 months with calcium

	Recommendations
Product	High-viscosity HA or CaHA*
Volume	Up to 2 ml per hand (0.2 ml per injection for multiple injection points)
Technique	
Needle	Single bolus or multiple boluses in dorsum of the hand at one or multiple injection points; tent- ing technique
Cannula	One entry at dorsal wrist and distribution of filler by fanning technique (indicated by yellow star in Fig. 18)
	or
	Approximately four interdigital entry points and distribution of filler by linear threading (indi- cated by blue stars in Fig. 18)
Injection plane	Between the subcutaneous layer and superficial fascia
HA hvaluronic acid: Ca	HA calcium hydroxylapatite

Table 15.	Recommendations for	Augmentation	of the Hand
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*May be diluted before injection.

Table 16. Recommendations for the Prevention and Management of Complications

	Prevention	Management
Noninflammatory nodules (depots of material)*	 Conservative treatment (undercorrection) Avoidance of high-risk areas (e.g., no CaHA for lip augmentation) 	 Hyaluronidase (in the case of an HA filler) Firm massage Puncture nodule and squeeze out product
	• Further dilution with lidocaine, if applicable†	• Needle dispersion with or without saline or lidocaine
T C ··	• Massage	
Infection	• Sterile devices	• Culture
	Scrupulous antiseptic skin-cleansing	Treatment with broad-spectrum antibiotic and following antibiogram whenever possible
	• Protocol before, during, and after procedure	
	Aseptic technique	
Vascular events*‡	• Knowledge of vascular anatomy and signs of ischemia	 Immediate halting of injection/retraction of plunger
	 Check for blood vessel 	• Hyaluronidase (in the case of an HA filler)
	 Hyaluronidase in office 	• Massage
	• No general anesthesia or regional blocks	Warm packing
	• Deep, slow injections, with minimal pressure	 Medication (steroid, aspirin, nitropaste or sublingual nitroglycerine; IV heparin)
	 Small amounts of filler 	
	 Possible risk reduction with cannula 	
	 Aspiration before injection in areas of risk, if possible 	

HA, hyaluronic acid; CaHA, calcium hydroxylapatite; IV, intravenous.

*Strong consensus.

†Off-label indication.

[‡]Vascular events are very rare. The recommendations are based on expert opinion. Special care should be taken to avoid injection into the blood vessels. Introduction of filler material into the vasculature may occlude the vessels and could cause infarction or embolism, leading to ischemia, necrosis, or scarring, particularly in the lips, nose, glabella, or ocular area. Complications associated with other injectables indicate that the forceful injection into superficial dermal vessels of the glabella and nose could cause retrograde movement into the retinal arteries, resulting in vascular occlusion.

hydroxylapatite, and only a small number of granulomas have been reported over a decade of use.67-69

SUMMARY

The Asia-Pacific Consensus recommendations focus on soft-tissue augmentation practices across Asia. The Asian face requires special consideration in terms of anatomy and aesthetic needs. Augmentation focuses primarily on modification

of congenital specifics and, to a lesser extent, the correction of age-related disharmonies. Because of regional differences that are often influenced by trends, rather than by traditional ideals of beauty, it is imperative to discuss goals and possible outcomes with patients before treatment. What is popular in one region may be inappropriate in another.

The recommendations place emphasis on augmentation in the midface first when treating multiple areas. Volume restoration of the medial fat compartments lifts the cheeks and may improve the appearance of the tear troughs, nasolabial folds, and mouth corners. Augmentation of the forehead, nose, and chin completes the synthesis of the convex Asian face into a more projected, three-dimensional profile.

The use of either cannula or needle will depend on injector experience and preference. Needles allow for more precise placement of filler but are more likely to damage vascular structures. Cannulas reduce the number of insertion points in larger areas to fill and may reduce the risk of vascular complications; however, long cannulas used for multiple entry points may increase the risk of contamination and subsequent infection.

The Consensus group discussed serious complications and has recommended both prevention and treatment strategies. Preparation (in terms of knowledge of anatomy and vascular structures) and prevention (by using proper technique with appropriate fillers) will avoid many complications. The recommendations do not cover every possible adverse event and are not comprehensive in scope. More detailed discussions about complications after soft-tissue augmentation have been published elsewhere.^{32,51,54,64,70,71}

Based on extensive clinical experience, the Asia-Pacific Consensus recommendations are the first developed specifically for the use of fillers in Asian populations and are intended for injectors worldwide who wish to better familiarize themselves with Asian indications and injection procedures for optimal outcomes with a high level of safety when using cohesive polydensified matrix/hyaluronic acid and/or calcium hydroxylapatite.

Nark-Kyoung Rho, M.D.

Leaders Aesthetic Laser & Cosmetic Surgery Center The Classic 500 Building 90, Neungdong-ro, Gwangjin-gu Seoul 143-854, Republic of Korea rhonark@hanmail.net

PATIENT CONSENT

Patients provided written consent for the use of their images.

REFERENCES

1. Lee SK, Kim SD, Rho NK, et al. Studies on the preferred filler and injection techniques of 10 Korean dermatologists according to each indication. *J Korean Soc Aesthet Dermatol Surg.* 2011;3:17–25.

- Ahn BK, Kim YS, Kim HJ, Rho NK, Kim HS. Consensus recommendations on the aesthetic usage of botulinum toxin type A in Asians. *Dermatol Surg.* 2013;39:1843–1860.
- Schünemann HJ, Jaeschke R, Cook DJ, et al.; ATS Documents Development and Implementation Committee. An official ATS statement: Grading the quality of evidence and strength of recommendations in ATS guidelines and recommendations. *Am J Respir Crit Care Med.* 2006;174:605–614.
- Sundaram H, Cassuto D. Biophysical characteristics of hyaluronic acid soft-tissue fillers and their relevance to aesthetic applications. *Plast Reconstr Surg.* 2013;132(Suppl 2):5S–21S.
- 5. Borrell M, Leslie DB, Tezel A. Lift capabilities of hyaluronic acid fillers. *J Cosmet Laser Ther.* 2011;13:21–27.
- 6. Kühne U, Imhof M, Kirchmeir M, Howell DJ. Five-year retrospective review of safety, injected volumes, and longevity of the hyaluronic acid Belotero Basic for facial treatments in 317 patients. *J Drugs Dermatol.* 2012;11:1032–1035.
- Narins RS, Coleman W, Donofrio L, et al. Nonanimal sourced hyaluronic acid-based dermal filler using a cohesive polydensified matrix technology is superior to bovine collagen in the correction of moderate to severe nasolabial folds: Results from a 6-month, randomized, blinded, controlled, multicenter study. *Dermatol Surg.* 2010;36;1:730–740.
- 8. Narins RS, Brandt FS, Dayan SH, Hornfeldt CS. Persistence of nasolabial fold correction with a hyaluronic acid dermal filler with retreatment: Results of an 18-month extension study. *Dermatol Surg.* 2011;37:644–650.
- Prager W, Steinkraus V. A prospective, rater-blind, randomized comparison of the effectiveness and tolerability of Belotero Basic versus Restylane for correction of nasolabial folds. *Eur J Dermatol.* 2010;20:748–752.
- Prager W, Wissmueller E, Havermann I, et al. A prospective, split-face, randomized, comparative study of safety and 12-month longevity of three formulations of hyaluronic acid dermal filler for treatment of nasolabial folds. *Dermatol Surg.* 2012;38:1143–1150.
- Graivier MH, Bass LS, Busso M, Jasin ME, Narins RS, Tzikas TL. Calcium hydroxylapatite (Radiesse) for correction of the mid- and lower face: Consensus recommendations. *Plast Reconstr Surg.* 2007;120(Suppl):55S–66S.
- Tzikas TL. A 52-month summary of results using calcium hydroxylapatite for facial soft tissue augmentation. *Dermatol Surg.* 2008;34(Suppl 1):S9–S15.
- Marmur ES, Phelps R, Goldberg DJ. Clinical, histologic and electron microscopic findings after injection of a calcium hydroxylapatite filler. *J Cosmet Laser Ther.* 2004;6:223–226.
- Berlin AL, Hussain M, Goldberg DJ. Calcium hydroxylapatite filler for facial rejuvenation: A histologic and immunohistochemical analysis. *Dermatol Surg.* 2008;34(Suppl 1):S64–S67.
- 15. Yutskovskaya Y, Kogan E, Leshunov E. A randomized, splitface, histomorphologic study comparing a volumetric calcium hydroxylapatite and a hyaluronic acid-based dermal filler. *J Drugs Dermatol.* 2014;13:1047–1052.
- 16. Busso M, Voigts R. An investigation of changes in physical properties of injectable calcium hydroxylapatite in a carrier gel when mixed with lidocaine and with lidocaine/epinephrine. *Dermatol Surg.* 2008;34(Suppl 1):S16–S23; discussion S24.
- 17. Marmur E, Green L, Busso M. Controlled, randomized study of pain levels in subjects treated with calcium hydroxylapatite premixed with lidocaine for correction of nasolabial folds. *Dermatol Surg.* 2010;36:309–315.
- Pavicic T. Calcium hydroxylapatite filler: An overview of safety and tolerability. *J Drugs Dermatol.* 2013;12:996–1002.
- Lam SM. Aesthetic strategies for the aging Asian face. Facial Plast Surg Clin North Am. 2007;15:283–291, v.

- Kim MM, Byrne PJ. Facial skin rejuvenation in the Asian patient. Facial Plast Surg Clin North Am. 2007;15:381–386, vii.
- Batniji RK, Perkins SW. Upper and midfacial rejuvenation in the non-Caucasian face. *Facial Plast Surg Clin North Am.* 2010;18:19–33.
- 22. Tsukahara K, Fujimura T, Yoshida Y, et al. Comparison of age-related changes in wrinkling and sagging of the skin in Caucasian females and in Japanese females. *J Cosmet Sci.* 2004;55:351–371.
- 23. Broer PN, Juran S, Liu YJ, et al. The impact of geographic, ethnic, and demographic dynamics on the perception of beauty. *J Craniofac Surg.* 2014;25:e157–e161.
- 24. Wysong A, Joseph T, Kim D, Tang JY, Gladstone HB. Quantifying soft tissue loss in facial aging: A study in women using magnetic resonance imaging. *Dermatol Surg.* 2013;39:1895–1902.
- Wysong A, Kim D, Joseph T, MacFarlane DF, Tang JY, Gladstone HB. Quantifying soft tissue loss in the aging male face using magnetic resonance imaging. *Dermatol Surg.* 2014;40:786–793.
- Busso M, Mariwalla K, Howell DJ. Forehead and temporal recontouring using calcium hydroxylapatite pre-mixed with lidocaine. In: Carruthers J, Carruthers A, eds. Soft Tissue Augmentation. New York: Elsevier; 2013:81–87.
- 27. Jung W, Youn KH, Won SY, Park JT, Hu KS, Kim HJ. Clinical implications of the middle temporal vein with regard to temporal fossa augmentation. *Dermatol Surg.* 2014;40:618–623.
- Haddock NT, Saadeh PB, Boutros S, Thorne CH. The tear trough and lid/cheek junction: Anatomy and implications for surgical correction. *Plast Reconstr Surg.* 2009;123: 1332–1340; discussion 1341.
- 29. Yang HM, Lee JG, Hu KS, et al. New anatomical insights on the course and branching patterns of the facial artery: Clinical implications of injectable treatments to the nasolabial fold and nasojugal groove. *Plast Reconstr Surg.* 2014;133:1077–1082.
- Rohrich RJ, Pessa JE. The fat compartments of the face: Anatomy and clinical implications for cosmetic surgery. *Plast Reconstr Surg.* 2007;119:2219–2227; discussion 2228.
- Seo KK-II. Nose. In: Carruthers J, Carruthers A, eds. Soft Tissue Augmentation. New York: Elsevier; 2012:112–122.
- Ozturk CN, Li Y, Tung R, Parker L, Piliang MP, Zins JE. Complications following injection of soft-tissue fillers. *Aesthet* Surg J. 2013;33:862–877.
- Wong WW, Davis DG, Camp MC, Gupta SC. Contribution of lip proportions to facial aesthetics in different ethnicities: A three-dimensional analysis. *J Plast Reconstr Aesthet Surg.* 2010;63:2032–2039.
- Hilinski JM, Cohen SR. Volumetric use of injectable fillers in the face. In: Cohen SR, Born TM, eds. *Facial Rejuvenation* with Fillers. Oxford: Saunders Elsevier; 2009:77–92.
- Ghersetich I, Lotti T, Campanile G, Grappone C, Dini G. Hyaluronic acid in cutaneous intrinsic aging. *Int J Dermatol.* 1994;33:119–122.
- 36. Weindl G, Schaller M, Schäfer-Korting M, Korting HC. Hyaluronic acid in the treatment and prevention of skin diseases: Molecular biological, pharmaceutical and clinical aspects. *Skin Pharmacol Physiol.* 2004;17:207–213.
- Kerscher M, Bayrhammer J, Reuther T. Rejuvenating influence of a stabilized hyaluronic acid-based gel of nonanimal origin on facial skin aging. *Dermatol Surg.* 2008;34:720–726.
- Williams S, Tamburic S, Stensvik H, Weber M. Changes in skin physiology and clinical appearance after microdroplet placement of hyaluronic acid in aging hands. J Cosmet Dermatol. 2009;8:216–225.

- Streker M, Reuther T, Krueger N, Kerscher M. Stabilized hyaluronic acid-based gel of non-animal origin for skin rejuvenation: Face, hand, and décolletage. *J Drugs Dermatol.* 2013;12:990–994.
- Reuther T, Bayrhammer J, Kerscher M. Effects of a three-session skin rejuvenation treatment using stabilized hyaluronic acid-based gel of non-animal origin on skin elasticity: A pilot study. Arch Dermatol Res. 2010;302:37–45.
- Wang F, Garza LA, Kang S, et al. In vivo stimulation of de novo collagen production caused by cross-linked hyaluronic acid dermal filler injections in photodamaged human skin. *Arch Dermatol.* 2007;143:155–163.
- Distante F, Pagani V, Bonfigli A. Stabilized hyaluronic acid of non-animal origin for rejuvenating the skin of the upper arm. *Dermatol Surg.* 2009;35(Suppl 1):389–393; discussion 394.
- Taieb M, Gay C, Sebban S, Secnazi P. Hyaluronic acid plus mannitol treatment for improved skin hydration and elasticity. *J Cosmet Dermatol.* 2012;11:87–92.
- 44. Waldorf HA, Fernandes NF, Patel RV. Hands and feet. In: Carruthers J, Carruthers A, eds. *Soft Tissue Augmentation*. New York: Elsevier; 2013:155–159.
- 45. Busso M, Moers-Carpi M, Storck R, et al. Multicenter, randomized trial assessing the effectiveness and safety of calcium hydroxylapatite for hand rejuvenation. *Dermatol Surg.* 2010;36:790–797.
- Fabi SG, Goldman MP. Hand rejuvenation: A review and our experience. *Dermatol Surg.* 2012;38:1112–1127.
- Bidic SM, Hatef DA, Rohrich RJ. Dorsal hand anatomy relevant to volumetric rejuvenation. *Plast Reconstr Surg.* 2010;126:163–168.
- Sadick NS. A 52-week study of safety and efficacy of calcium hydroxylapatite for rejuvenation of the aging hand. J Drugs Dermatol. 2011;10:47–51.
- 49. Rzany B, Bachmann F, Nast A. Adverse reaction to fillers: Diagnosis and management. *Hautarzt* 2013;64:163–170.
- 50. Ledon JA, Savas JA, Yang S, Franca K, Camacho I, Nouri K. Inflammatory nodules following soft tissue filler use: A review of causative agents, pathology and treatment options. *Am J Clin Dermatol.* 2013;14:401–411.
- Funt D, Pavicic T. Dermal fillers in aesthetics: An overview of adverse events and treatment approaches. *Clin Cosmet Investig Dermatol.* 2013;6:295–316.
- 52. Lee A, Grummer SE, Kriegel D, Marmur E. Hyaluronidase. Dermatol Surg. 2010;36:1071–1077.
- Glashofer MD, Flynn TC. Complications of temporary fillers. In: Carruthers J, Carruthers A, eds. *Soft Tissue Augmentation*. New York: Elsevier; 2013:179–187.
- Beer K, Downie J, Beer J. A treatment protocol for vascular occlusion from particulate soft tissue augmentation. *J Clin Aesthet Dermatol.* 2012;5:44–47.
- 55. Coleman SR. Avoidance of arterial occlusion from injection of soft tissue fillers. *Aesthet Surg J.* 2002;22:555–557.
- Sung MS, Kim HG, Woo KI, Kim YD. Ocular ischemia and ischemic oculomotor nerve palsy after vascular embolization of injectable calcium hydroxylapatite filler. *Ophthal Plast Reconstr Surg.* 2010;26:289–291.
- Lazzeri D, Agostini T, Figus M, Nardi M, Pantaloni M, Lazzeri S. Blindness following cosmetic injections of the face. *Plast Reconstr Surg.* 2012;129:995–1012.
- 58. Park SW, Woo SJ, Park KH, Huh JW, Jung C, Kwon OK. Iatrogenic retinal artery occlusion caused by cosmetic facial filler injections. *Am J Ophthalmol.* 2012;154:653–662.e1.

- 59. Roberts SA, Arthurs BP. Severe visual loss and orbital infarction following periorbital aesthetic poly-(L)-lactic acid (PLLA) injection. *Ophthal Plast Reconstr Surg.* 2012;28:e68–e70.
- Ozturk CN, Li Y, Tung R, Parker L, Piliang MP, Zins JE. Complications following injection of soft-tissue fillers. *Aesthet* Surg J. 2013;33:862–877.
- 61. 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;134:1197–1201.
- Hayreh SS, Podhajsky PA, Zimmerman B. Nonarteritic anterior ischemic optic neuropathy: Time of onset of visual loss. *Am J Ophthalmol.* 1997;124:641–647.
- Hirsch RJ, Brody HJ, Carruthers JD. Hyaluronidase in the office: A necessity for every dermasurgeon that injects hyaluronic acid. *J Cosmet Laser Ther.* 2007;9:182–185.
- 64. Alijotas-Reig J, Fernández-Figueras MT, Puig L. Inflammatory, immune-mediated adverse reactions related to soft tissue dermal fillers. *Semin Arthritis Rheum*. 2013;43:241–258.
- 65. Bardazzi F, Ruffato A, Antonucci A, Balestri R, Tabanelli M. Cutaneous granulomatous reaction to injectable

hyaluronic acid gel: Another case. J Dermatolog Treat. 2007;18:59-62.

- Park TH, Seo SW, Kim JK, Chang CH. Clinical experience with hyaluronic acid-filler complications. J Plast Reconstr Aesthet Surg. 2011;64:892–896.
- 67. Fried I, Pincus LB, North J, El-Shabrawi-Caelen L. Basal cell carcinoma with a bonus. *J Cutan Pathol.* 2011;38:261–263.
- Daley T, Damm DD, Haden JA, Kolodychak MT. Oral lesions associated with injected hydroxyapatite cosmetic filler. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2012;114:107–111.
- Moulonguet I, Arnaud E, Bui P, Plantier F. Foreign body reaction to Radiesse: 2 cases. Am J Dermatopathol. 2013;35:e37–e40.
- Kim DW, Yoon ES, Ji YH, Park SH, Lee BI, Dhong ES. Vascular complications of hyaluronic acid fillers and the role of hyaluronidase in management. *J Plast Reconstr Aesthet Surg.* 2011;64:1590–1595.
- Cassuto D, Sundaram H. A problem-oriented approach to nodular complications from hyaluronic acid and calcium hydroxylapatite fillers: Classification and recommendations for treatment. *Plast Reconstr Surg.* 2013;132(Suppl 2): 48S–58S.



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