

Counseling patients on facial volume replacement and adherence with posttreatment instructions

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Abstract: Use of injectable volume replacement products has increased dramatically in the US in recent years. An optimal outcome with volume replacement depends on a thorough knowledge of the products on the part of the dermatologic/aesthetic physician specialist, identification of patients with a likelihood of benefiting from volume replacement procedures, selection of an appropriate product for the individual patient, and effective patient counseling to ensure adherence to posttreatment care instructions. Adherence to physician instructions in the field of dermatology appears limited, and there is very little published information on adherence to physician instructions following facial volume replacement procedures. The purpose of this review is to provide strategies for understanding and overcoming the barriers to adherence with the widely used dermal fillers. Strategies include using patient-centered techniques, such as a motivational interview encouraging the patient to follow postprocedure care instructions, eg, massage. In this case, demonstrating massage techniques while the patient is still in the office, with patient participation and detailed feedback, also contributes to good adherence with posttreatment care instructions. Telephone counseling, reminder postcards, and text messages may help improve clinic attendance for follow-up. Motivated patients who demonstrate good adherence to physician instructions generally respond well to volume replacement treatments, and usually experience fewer adverse events than patients who do not follow instructions. Although promoting adherence to pretreatment and posttreatment protocols remains a challenge, patient counseling throughout the treatment process can lead to successful results.

Keywords: improving adherence, injectable volume replacement, product selection, rejuvenation procedure, soft tissue augmentation

Introduction

The use of injectable volume replacement products in facial rejuvenation procedures has increased dramatically in the US in recent years.¹ An optimal outcome from a rejuvenation procedure depends on a thorough knowledge of the products and their injection techniques on the part of the dermatologic/aesthetic physician specialist, identification of patients with a likelihood of benefiting from volume replacement procedures, selection of an appropriate product for the individual patient, and effective patient counseling.² Adherence to a treatment protocol may be defined as the patient following treatment instructions provided by her/his physician; it is known that failure to do so can result in wasted resources and may cause increased morbidity and mortality.³⁻⁵ Individualized counseling for each patient, based on treatment selection, is paramount for improving adherence and achieving successful outcomes. This review discusses the barriers to adherence and strategies for

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overcoming them, as well as the prerequisites for successful outcomes in patients treated with injectable dermal fillers. It also provides an overview of widely used dermal fillers, and suggests strategies that may be helpful for physicians to adopt when counseling patients to enhance their adherence and treatment success.

Barriers to patient adherence

Limited patient adherence to physician instructions is widespread in dermatology,^{4,6} suggesting that patients may be more likely to adhere to medication regimens than to behavior changes.³ Adherence may be influenced by demographic factors, education level, and socioeconomic status,⁵ the presence of comorbidities requiring medication that cannot readily be discontinued for the procedure,^{7,8} and psychiatric disorders, such as depression and anxiety.⁵ Furthermore, logistic issues, such as a long wait for a follow-up appointment, can reduce adherence.⁹

Communication barriers are also known to limit adherence.^{5,10,11} According to a meta-analysis of a large number of clinical trials and experimental interventions across a range of therapeutic areas, poor communication leads to a 19% greater risk of poor adherence or non-adherence.¹¹ Extrapolating from the number of medical office visits made in the US in 2005, the authors of this meta-analysis estimated that stronger physician interpersonal communication skills could have led to improved adherence in more than 183 million office visits that year.¹¹ Perhaps the most obvious communication barrier is when a patient who does not speak the same language as the physician; the absence of a translator and the lack of translated written instructions present challenges that may impact adherence.¹⁰ Even when a patient speaks the same language, it is important for the physician to avoid making assumptions about the patient's baseline knowledge and understanding of the situation,⁵ and to conduct patient counseling sessions accordingly.

Strategies for improving patient adherence

A trusting patient-physician relationship fosters adherence to pretreatment and posttreatment protocols.^{2,4,6,12} Additionally, counseling patients about the importance of adherence during the initial consultation and at each follow-up visit can be beneficial.¹³ Physicians can also use patient-centered techniques, such as motivational interviewing, to encourage self-management.¹⁴ Motivational interviewing facilitates discussion about self-care practices in a nonjudgmental

atmosphere and helps patients integrate these practices into their schedules.¹⁴ For example, during counseling sessions the physician might ask open-ended questions, such as, "What do you see as the benefits of adhering to your posttreatment instructions?" and "Thinking about your typical day, how might you find time to massage the treated area?" Telephone counseling can also promote treatment adherence.¹⁵ Telephone calls, reminder postcards, and text messages can improve attendance at follow-up visits^{9,16} and provide additional opportunities for further counseling throughout patient treatment. For example, automated telephone reminders significantly improve adherence in patients who require repeat mammography.¹⁷

In the management of glaucoma, patient education has been found to be helpful in improving adherence,¹⁸ although studies of this issue have proven difficult.¹⁹ However, techniques for communication appear to extend beyond patient education with printed material;²⁰ if using this format, the text should meet certain guidelines for clarity.²¹

A large meta-analysis across multiple therapeutic areas has shown that while it is possible to demonstrate improved adherence to medication instructions, there may be little impact on clinical parameters.²² Furthermore, the authors suggest that simplification of dosing, monitoring, and feedback, and providing information over a number of counseling sessions, may be effective.²² Although the applicability of these findings to patients undergoing soft tissue rejuvenation is unknown, there could be benefits in utilizing some of the counseling strategies to help achieve better patient adherence.

For example, the demonstration of after-care techniques while the patient is still in the office is an effective means of encouraging posttreatment self-care and adherence. Such demonstrations can include, after positioning a mirror to maximize the patient's field of vision, a review of appropriate massage techniques, with patient participation to help review the correct techniques, and to reinforce the importance of posttreatment self-care with the patient.

Prerequisites for successful patient outcomes

Achieving a successful outcome in soft tissue augmentation is multifactorial. The training and experience of the physician with the procedures and products are particularly important, but effective counseling during screening of the patient and selection of the appropriate product to use will also have an impact on the outcome. Finally, careful follow-up by the patient is essential in reducing the risk of adverse events

(AEs). Each element is discussed in more detail in the following sections.

Physician training

Dermatologic/aesthetic physician specialists need to receive in-depth training before using soft tissue augmentation products.^{2,23} In addition to being familiar with the prescribing information and peer-reviewed literature for an agent, physicians should have observed the administration of the product by a trained expert before using the product themselves.² It is advisable for physicians who are starting to use dermal fillers to gain experience with temporary fillers before incorporating long-term and permanent fillers in their practice.²⁴ This approach also ensures that patients are satisfied with the scope of their planned augmentation procedures. Understanding the depth at which the various products should be placed is particularly important.^{2,24}

Patient counseling and pretreatment screening

Effective patient screening during the initial consultation is a prerequisite for successful facial soft tissue augmentation procedures.²⁵ Appropriate candidates for soft tissue augmentation are individuals who demonstrate, after discussion with the physician, an understanding of the nature of dermal filling procedures, realistic expectations about aesthetic outcomes, a commitment to assist with their pretreatment and posttreatment care, and a willingness to schedule and attend follow-up examinations and additional or touch-up treatments as necessary.² It is important that patients explain their motivation for having the procedure (eg, achieving a long-lasting rather than an immediate improvement in appearance). This allows physicians to recommend products consistent with patient objectives and to provide an overview of the pretreatment and posttreatment care the patient should follow for optimal results.

The physician should also review and discuss the patient's full medical history, including current prescription and over-the-counter medication use.² If approved by the primary care physician, nonessential aspirin, nonsteroidal anti-inflammatory agents, and vitamin/herbal supplements that have anticoagulant effects should be discontinued 10 days before treatment to minimize the risk of bruising and swelling.^{7,8} Patients with active skin inflammation or infection in or near the proposed treatment area should be advised to defer treatment until the inflammatory or infectious process has been controlled.²⁶⁻²⁸ Finally, prophylactic antiviral and/or antibacterial therapy should be considered

for patients who are susceptible to infection or have a history of herpes simplex viral infections.²⁹

Patient counseling and product selection

The soft tissue augmentation product that meets the patient's overall objectives is often identified in the pretreatment counseling session, during which the benefits and limitations (including the AE profile) of the various devices are fully discussed. Some patients prefer the hyaluronic acids because they perceive these injectables to be more natural, whereas others choose products with longer-lasting results. Still others may have their decision influenced by cultural and perceptual factors (eg, preference not to use a product of bovine origin). Moreover, the patient's history of allergic reactions may further eliminate some products from consideration. For some patients, cost may be an important factor in product selection, influencing the number of treatment sessions that can be planned and the intervals between them.

Again, during pretreatment counseling, it is important for the physician to have an open dialog with the patient (ask questions about the patient's goals, expectations, and reasons for the cosmetic procedure) and to determine clinically the area and extent of volume loss requiring correction; this will help narrow the range of options that need to be discussed in detail. Some clinicians may also recommend that patients begin dermal filler therapy with a shorter-acting agent so that they can decide whether they like the effects of treatment before committing themselves to a long-term approach.^{30,31}

Posttreatment follow-up

Because each patient has different needs, and each product has different requirements, it is important for physicians to individualize their approach to posttreatment counseling. Posttreatment patient care and follow-up requirements can play a key role in product selection. Repeating information relating to time commitment and adherence requirements after treatment will reinforce the relevant information necessary to ensure adherence. The physician should also stress the importance of adherence to posttreatment care as it relates to specific products so that the patient understands the differences between the available options and to ensure he or she can commit to the follow-up treatment needed to achieve the patient's desired results.

In general, exposure of the treated area to excessive sun, heat, and ultraviolet light from lamps should be minimized for approximately 24 hours or until any initial swelling and erythema have resolved.^{26,27} An ice or cold pack can be used to minimize tenderness, swelling, and bruising

following instruction from the physician on how to apply it.²⁶ Patients should also be instructed to report any AEs, other than mild local reactions, to their physician.

Overview of dermal fillers

Dermal fillers may be categorized by their duration of action as short-acting, long-acting, or permanent products. Their characteristics are summarized in Table 1.²⁹ Short-acting products (collagens, hyaluronic acid [HA] derivatives) have durations of effect of up to one year. Long-acting agents (calcium hydroxylapatite [CaHA], injectable poly-L-lactic acid [PLLA]) have durations of effect of one to two years. The effects of the one currently available permanent dermal filler (polymethylmethacrylate [PMMA] microspheres for injection) lasts for several years and may persist indefinitely.

Short-acting dermal fillers

The short-acting dermal filler category encompasses bovine and cell-cultured collagen of human or avian origin (Table 1).²⁹ The most widely used collagen implants are bovine-derived and human-derived bioengineered products.^{24,32} Although these implants have an immediate effect, which may be highly desired by some patients, a small number of additional injections at intervals of two or more weeks may be needed to achieve the desired level of initial correction.³³ The interval is likely to be longer with the longer-acting collagens.³⁴

The duration of effect and uses of individual HA products vary on the basis of their particle size, the extent of cross-linking, and the location of the implant (Table 1).^{29,31,35} These products have an immediate effect, but touch-up sessions may be needed after one to two weeks.³⁶ The touch-up session requires the patient to return to the office, which may require additional follow-up to ensure compliance.

Use of bovine-derived collagen necessitates an intradermal skin test, performed at least four weeks before the desired procedure, to screen for hypersensitivity reactions.^{37,38} If the response is equivocal, a second test should be performed and the patient's reaction should be observed for another four weeks.³⁸ Physicians should carefully counsel patients on the reasons for the test and the need for careful interpretation of the results to ensure compliance. Testing is not needed when human-derived collagen implants or HA derivatives are used.^{32,35}

In addition to following the general guidelines described above, patients who have received collagen implants or HA derivatives should avoid strenuous exercise and consumption of alcoholic beverages for the first 24 hours posttreatment.^{33,39,40} Makeup may be applied a few hours after treatment if there are

no complications (eg, open wounds, bleeding, or infection).^{33,39,40} Patients treated with HA derivatives should be counseled to avoid exposure to extreme cold weather as much as possible until any initial swelling and redness have resolved.⁴¹

Long-acting dermal fillers

The long-acting types of dermal filler include CaHA and injectable PLLA.

Calcium hydroxylapatite

CaHA is a gel suspension of microspheres that is used to correct a variety of deep dermal and subcutaneous defects (Table 1).^{7,26,29} The product is often injected at the dermal-subcutaneous border.^{2,26} People considering this approach should be advised that follow-up treatment and periodic maintenance treatments may also be needed.²⁶ Patients should also be counseled that although the effect of CaHA injection appears to be immediate, some of this may appear to diminish during the first week as the initial swelling in response to the injection subsides.⁴²

During the treatment session, massage of the treated area may be required to ensure that CaHA is distributed evenly, but following treatment with CaHA, patients should avoid significant movement or massage of the treated area and should not apply makeup for approximately 24 hours.²⁶ If nodules develop, the patient should be advised to return quickly for puncture and expression of the contents.⁷ CaHA is a radiopaque substance that is visible on computed tomography and x-ray scans, although it has a lower radiodensity than bone or teeth.^{7,26} Therefore, before undergoing imaging studies, patients should inform health care providers if they have received this product.²⁶

Injectable poly-L-lactic acid

Injectable PLLA was recently approved by the US Food and Drug Administration for use in immune competent people as a single regimen for the correction of shallow to deep nasolabial fold contour deficiencies and other facial wrinkles in which deep dermal grid pattern injection technique is appropriate.²⁸ Injectable PLLA is a polymeric device containing microparticles of PLLA with carboxymethylcellulose and mannitol which, unlike other dermal fillers, must be reconstituted with sterile water (5 mL) for injection before use.²³ The reconstitution time of at least two hours but not more than 72 hours may give rise to challenges for physicians who are planning treatment sessions, especially with the longer reconstitution times recommended by some investigators.^{8,23} Depending on the area to be treated, the product should be

Table 1 Dermal fillers currently available and widely used for soft tissue augmentation^a

Filler type	Product	Uses	Durability	Advantages	Disadvantages
Short-acting Bovine collagen	Zyderm [®] I (3.5% dermal collagen)	Superficial defects, fine lines, acne scars	2–4 months	Safe, reliable, easy to administer	Allergic reaction in 1%–3% of patients, short-term results, requires skin testing before use, possible reactivation of herpes with lip injections Same as Zyderm I
	Zyderm 2 (6.5% collagen)	Moderate defects, deeper acne scars, lip augmentation	2–6 months	Same as Zyderm I	Can cause skin necrosis if used in glabella, allergies in 3%, requires skin testing
	Zyplast [®] (cross-linked collagen)	Deep defects, lip augmentation	2–6 months	Same as Zyderm I, but more viscous and resistant to degradation	Short-term results; common side effects include cold symptoms (4%) and flu symptoms (2%) Same as Cosmoderm
	Cell-cultured human collagen	Superficial defects, shallow wrinkles, acne scars	3–4 months	Safe, no allergy testing required, contains lidocaine	Short-term results, immunologic reactions in patients allergic to avian products (eggs) Same as Hylaform gel, superficial injection may lead to skin discoloration
Avian-derived hyaluronic acids	Cosmoderm [®] (35 mg/mL collagen)	Deeper defects and wrinkles, lip augmentation	3–4 months	Same as Cosmoderm	Short-term results, rare immunologic reactions, relatively new product Same as Restylane
	Cosmoplast [®] (35 mg/mL cross-linked collagen)	Moderate defects, lip augmentation	3–4 months	Safe, reliable, no allergy testing required	Rare immunologic reactions, higher incidence of bruising, pain, and post-procedure swelling vs bovine collagens, higher cost
	Hylaform [®] Plus	Moderate to deeper defects, facial wrinkles, folds	3–4 months	Same as Hylaform gel	In rare instances, nodules can develop if the product is injected superficially
Bacterial-cultured hyaluronic acids	Juvéderm [®] Ultra	Superficial (18), moderate (24), and deep (30) defects	6–12 months	Safe, predictable results, no allergy testing needed	
	Perlane [®]	Deeper defects, shaping facial contours, lip augmentation	6–12 months	Same as Restylane	
Long-acting	Restylane [®] /Restylane Fine	Superficial (Restylane Fine) to moderate defects, deeper wrinkle reduction, nasolabial folds, glabellar creases, lip augmentation	6–12 months	Safe, reliable, predictable results, no allergy testing required, longer-lasting than bovine collagens	
	Radiesse [®] (calcium hydroxylapatite microspheres)	Correction of moderate to severe facial wrinkles and folds (eg, nasolabial folds) and for correction of signs of lipoatrophy in persons with HIV infection ²⁶	1–2 years	Long-term results, no allergy testing required, no concern for antigenic or inflammatory reactions	
Permanent	Sculptra [®] Aesthetic and Sculptra [®] (poly-L-lactic acid microparticles)	Sculptra Aesthetic is used in immune competent people for correction of shallow to deep nasolabial fold contour deficiencies and other facial wrinkles in which a deep dermal grid injection technique is appropriate. ²⁸ Sculptra is used in people with HIV, for the restoration and/or correction of signs of facial fat loss ²⁷	1–2 years	Long-term results, no allergy testing required, safe	Rare foreign body reaction; limited results from US studies
	Artefill [®] (polymethylmethacrylate microspheres) ⁴⁷	Indicated for correction of nasolabial folds, also used for glabellar and other deep defects; contraindicated for lip augmentation ⁴⁷	Permanent after nearly 50% resorption	Unrivaled longevity, probably safe, but reports of persistent erythema at injection site	Palpable if placed superficially or excessively. Avoid injecting into the lips and areas with thin overlying skin. Requires allergy testing

^aAdapted with permission from Buck DW II et al 2009.²⁹ Copyright © 2009 Elsevier.**Abbreviation:** HIV, human immunodeficiency virus.

injected into the deep dermis or subcutaneous layer, but avoiding superficial injection.^{8,27,43}

Patients who are considering treatment with injectable PLLA should be counseled that the product has a gradual onset of effect that occurs over several treatment sessions.^{43,44} Three sessions is the average number in immune competent subjects, and treatments should be scheduled a minimum of three weeks apart.⁴⁵ Subjects may require an interval between treatments of at least four to six weeks to minimize the possibility of overcorrection.^{43,44} Patients typically experience some degree of edema associated with the injection procedure that gives the appearance of a full correction by the end of the session, but this edema typically subsides in several hours to several days.^{27,46}

After treatment with injectable PLLA, massage is an integral component of the injection procedure and post-treatment care.⁴⁶ Physicians should massage the treated area immediately after injection to distribute the product evenly, and they should counsel patients to continue to massage the treated area for three to five minutes two or three times daily for at least three days postinjection to promote a more natural-looking correction.^{8,46} Patients may apply makeup a few hours after treatment if no complications are present.²⁷

Permanent dermal filler

The only currently available permanent dermal filler is an implant consisting of nonresorbable PMMA microspheres (Artefill®, Table 1)⁴⁷ suspended in a water-based bovine collagen carrier that also includes lidocaine hydrochloride.⁴⁸ The product requires deep dermal placement.⁴⁷ Successful implantation results in subdermal strands that form a support structure beneath the wrinkle, preventing further wrinkling.^{47,48}

People considering treatment with this product should be counseled that although results are immediate, repeated implantations at intervals of two or more weeks may be necessary until optimal results are achieved.⁴⁷ Because the PMMA microspheres are suspended in a carrier gel that contains bovine collagen, an immunogenicity test is required four weeks before treatment.⁴⁷ Before treatment, patients must be counseled that the effects will not diminish over time and that injected PMMA may become visible if facial volume changes occur as the patient continues to age.³⁰ Since the implant cannot be removed easily, the permanence of PMMA may be problematic if the patient becomes dissatisfied with the results of treatment.³⁰ As noted above, initial treatment with a short- or long-acting dermal filler can help patients fully assess whether they desire permanent changes to their appearance.^{30,31}

For the first three days after treatment with injectable PMMA, patients should be counseled to avoid extreme facial expressions, because such activity may push the PMMA more deeply into the subcutaneous layer and compromise the benefits of treatment.³⁰ Application of clear tape to the treated area can help to reduce facial mobility.⁴⁸

Adverse reactions to injectable dermal fillers

Injectable dermal fillers are generally safe and well tolerated.^{49,50} Inconsistent reporting precludes an accurate comparison of the AE profiles of the different injectable dermal fillers. Most AEs associated with these products occur shortly after injection and are localized, mild, and transient.⁸ Using a moisturizer or Vaseline® on the skin creates a smooth surface that can be helpful, but anti-inflammatory creams are not recommended. Only a very small percentage of AEs have a long-term detrimental impact on patients' appearance. However, because enhancing appearance is the usual motivation for seeking injectable filler treatment, the appearance of visible AEs may be particularly distressing to the patient.²

Minor AEs that occur within the first 14 days after treatment with injectable dermal fillers include skin discoloration, swelling, bruising, tenderness, and pain (Table 2).² Bruising tends to be especially severe in patients treated with blood-thinning medications or dietary supplements with blood-thinning properties.² Careful assessment of all medications/supplements during the initial counseling stages can help reduce the risks. Swelling and tenderness are usually more pronounced in patients treated with longer-acting fillers than in those who receive short-acting products.²

Hematoma is an uncommon event that results from inadvertent laceration of small facial blood vessels.² Early infection is a rare event that typically is caused by the herpes simplex virus or common skin pathogens, such as *Staphylococcus aureus*.² These are of particular concern because they may result in long-term pigmentary changes or small punctate scars.² Papules may result from injections that are excessive or placed too superficially.⁴⁹ Although papules may resolve with massage, they can persist for several months if a long-acting filler has been used.² The risks of each of these AEs can be minimized by careful attention to the injection technique. In addition, patients should be advised to avoid nonsteroidal anti-inflammatory drugs and omega-3 supplementation for two weeks prior to treatment. The physician should apply pressure immediately if a bruise forms, and cool packs should be applied intermittently for up to 24 hours after treatment. Severe but rare AEs include anaphylactic reactions, skin necrosis, blindness, and death.²⁹

Table 2 Frequency (%) of local adverse events occurring within the first 14 days posttreatment with widely used dermal fillers^{a,b}

Filler type	Product	Redness	Swelling/edema	Bruising	Pain/tenderness	Papules
Short-acting						
Bovine collagen	Zyderm I and 2 (3.5% and 6.5% dermal collagen)	<1	<1	<1	<1	20 (Zyderm® 2)
	Zyplast (3.5% cross-linked collagen) ^c	60	40	29	22	20
Cell-cultured collagen	Cosmoderm (35 mg/mL collagen) ^{39,d}	NR	NR	NR	NR	NR
	Cosmoplast (35 mg/mL cross-linked collagen) ^{39,d}	NR	NR	NR	NR	NR
Avian-derived hyaluronic acids	Hylaform (hylan B gel) ⁴⁰	63	35	41	32	23 ⁴¹
	Hylaform Plus ⁴¹	74	53	44	53 (pain) 20 (tenderness)	26
Bacterial-cultured hyaluronic acids	Juvéderm® Ultra Plus ³⁶	76	71	54	84	52
	Perlane ⁶¹	61.3–83.7	80.7–90.8	49.3–86.5	68.7–80.9 (pain) 86.7–92.2 (tenderness)	NR
	Restylane ⁶²	84.8	87	52.2	57.2 (pain) 77.5 (tenderness)	NR
Long-acting	Radiesse (calcium hydroxylapatite microspheres) ²⁶	36.1	49.2	57	53.4	NR
	Sculptra (injectable poly-L-lactic acid) ^{27,d}	NR	NR	NR	NR	NR
Permanent	Artefill® (polymethylmethacrylate microspheres) ^{47,d}	NR	NR	NR	NR	NR

^aAdapted with permission from Carruthers J et al 2009. Copyright © 2009 Journal of Drugs in Dermatology. ^bSource data derived from product information unless otherwise noted. ^cValues derived from Hylaform trial comparator data, except lumps values, which were derived from Cosmoderm product information. ^dAdverse events are not reported by duration in the product information for cell-cultured collagen products (Cosmoderm and Cosmoplast), injectable poly-L-lactic acid (Sculptra), and injectable polymethylmethacrylate microspheres (Artefill).

Abbreviation: NR, not reported.

Delayed AEs associated with dermal fillers include bacterial infections, sterile abscesses, implant migration, nodules, and granulomas.² Nodules are visible or nonvisible structures that typically arise several weeks after the injection of a product that is intended to be injected into the mid dermis or deeper.^{2,46,51} They consist of fluid droplets or microparticles surrounded by a normal foreign body reaction and are distinguished by their indurated nature and separation from the surrounding soft tissue.⁴⁶ They tend to remain the same size until they are absorbed, treated, or removed.⁴⁶ Nodules are believed to result from improper placement of a dermal filler, uneven distribution of the product in its suspension, or uneven dispersal in injected areas.^{46,52}

Nodules can arise within several weeks of most injectable dermal filler treatments,^{31,49,53} especially when the filler is injected too superficially.² Such nodules usually represent product clustering at a few well-defined locations and can be treated using a 25-gauge needle to break them up, injecting the area with sterile water, and performing aggressive massage.^{46,52} In contrast, nodules that appear

several months after injection may require treatment with an intralesional injection of triamcinolone, 5-fluorouracil, or methylprednisolone administered every one to two weeks, plus daily systemic therapy with low-dose prednisolone, doxycycline, or tetracycline.⁵² Nodules that fail to respond to more conservative treatment can be excised if they are large enough to warrant the procedure.^{46,52} Conscientious postinjection massage by physicians and patients may reduce the risk of developing nodules.^{8,52}

Granulomas may develop throughout the treated area, often many months to years after treatment with any dermal filler.^{46,54–59} The estimated incidence of granulomas is 0.1%–0.2%.^{2,46} Granulomas usually have poorly defined borders and are characterized by erythema, edema, and a violet color resulting from the presence of many congested capillaries.⁴⁶ Untreated granulomas may grow, although they sometimes resolve spontaneously.⁴⁶ The etiology of granulomas is unknown, but it is possible that trauma, surgery, or another stressor may stimulate macrophages to induce a foreign-body reaction.⁴⁶ It has also been suggested that

bacteria introduced during or after the initial injection may cause a low-grade chronic infection with ensuing fibrosis and the eventual development of a granuloma.⁶⁰ Intralesional steroid therapy, with or without an immunomodulator, is first-line treatment for granulomas.^{8,46} Intense pulsed light may be useful in the treatment of engorged capillaries.⁴⁶ Excision is not usually feasible, both because granulomas lack distinct borders and because removal attempts may result in fistulas, abscesses, and scars.⁴⁶

No formal studies of the incidence of nodules and granulomas and the factors that influence their formation were identified in the literature. However, in the author's clinical experience, it appears that patients are exposed to a lower risk of AEs when careful attention is paid to the details of injection preparation, technique and site, patient counseling on proper posttreatment care, and patient adherence to guidance provided during the counseling session.

Conclusion

Injectable facial volume replacement products have become an integral part of aesthetic cosmetic approaches. Optimal results with dermal fillers depend on thorough training, effective patient screening, and careful product selection and placement. Patient counseling and education by the physician about the procedure as well as consistent adherence to pretreatment and posttreatment self-care practices by the patient are critical for optimal results. Motivated patients who demonstrate good adherence to physicians' instructions generally respond well to volume replacement treatments and usually experience fewer AEs than those who are not so motivated. While promoting adherence to pretreatment and posttreatment protocols remains a challenge, patient counseling throughout the treatment process can lead to successful results. Additional research in this area is warranted.

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