

Review

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Lip rejuvenation and filler complications in the perioral region

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Abstract

Lip and perioral augmentation procedures have become increasingly popular over the last two decades due to cultural trends, emphasizing youth and beauty. An understanding of lip anatomy and aesthetics has traditionally formed the basis for successful results. However, as new technology becomes available, patient standards have increased, requiring an intricate understanding of filler properties and the advantages of different technical approaches. This chapter touches on pertinent anatomy and aesthetics of perioral evaluation. It also provides an overview of the properties of the fillers currently available in the United States marketplace for perioral rejuvenation. The technique and materials currently favored by the senior author are described in greater detail. Finally, the chapter will overview potential complications and recommended management.

Keywords: Hyaluronic acid, filler, lip augmentation, perioral augmentation, rheology

INTRODUCTION

Soft tissue augmentation with dermal fillers is still a rapidly-expanding field. The American Society of Plastic Surgeons reported that 2.2 million individuals received hyaluronic acid (HA) injections from plastic surgeons in 2019^[1]. This excludes care from other physician groups (i.e., dermatologists, facial plastic surgeons, etc.) and non-physician providers. This is an increasingly significant omission as patients



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increasingly rely on non-physician providers for their focused expertise and convenience. Failure to acknowledge an increasingly diverse provider group risks dilution of safety and aesthetic standards. Additionally, as clinical experience and filler technology improve, more attention should be specifically placed on improving aesthetic standards. A proactive approach is advised to protect these standards and the reputation of aesthetic medicine. This should include sharing outcomes and safety data amongst all provider groups and a growing emphasis on nuances of filler rheology and technique.

Early literature on soft tissue fillers focused on safety, patient and physician satisfaction, and potential adverse events^[2-5]. These topics are touched on below, but the focus of this chapter is to provide greater detail regarding optimal filler choice and procedure technique based on the senior author's (LDG) experience and rheologic properties of an increasingly diverse set of available HA fillers.

THE FILLER "REVOLUTION"

The lips and perioral region of the face have a strong association with youth, health, and beauty as demonstrated across cultural platforms of art, literature, and social media^[6-8]. Byrne and Hilger^[6] highlighted this by comparing magazine models across the past century with progressively fuller and more anteriorly positioned lips. The ideals of lip height and ratio have also been objectively described contextually with overall facial balance^[7] and social perception of youth, health, and beauty^[8].

The popularity of perioral filler augmentation over surgical procedures has anecdotally further altered beauty norms encountered in social media today. The authors assert that this trend toward soft tissue fillers should prompt a more discerning assessment of dynamic and three-dimensional (3D) outcomes. This may be counter-intuitive, but fillers rely primarily on tissue volumization, which necessarily alters tissue dynamics and 3D relationships of perioral subunits. Surgical procedures alternatively rely on repositioning, lifting, or shorting the lip, which do not change the inherent tissue properties or subunit relationships. Therefore, the frontier of natural-appearing outcomes following perioral filler augmentation relies heavily on understanding the effects of rheologic properties on both 3D volumization and lip movement.

A brief summary of HA technology is necessary to understand the role of rheology in filler choice. HA is a high-viscosity mucopolysaccharide naturally found in human connective tissues. It is preserved across species, making pure HA inherently biocompatible. Rheologic and physicochemical properties of different HA fillers are modified by implementing different post-synthesis processing methods that alter molecular properties such as particle size, percent cross-linking, and HA concentration [Table 1].

Elastic modulus (G') and cohesivity are commonly referred to when describing the ability of a filler to volumize or lift the tissue. G' is the best studied and most reliable property regarding clinical effect, compared to cohesivity or swelling factor (i.e., hydrophilicity)^[5]. It is most simply defined as a filler's firmness. More technically, G' is defined as the ability of a filler to resist dynamic forces^[5,11]. This contributes to tissue projection. Cohesivity is less understood but still considered important to tissue support. It is more specifically considered important to gel integrity by maintaining shape after implantation, which contributes to tissue expansion. Cohesivity has also been linked to reduced surface irregularities^[11]. The difference between these two properties may seem ambiguous, but Rohrich *et al.*^[5] more directly differentiated these properties by explaining them as vertical *vs.* horizontal volumization for G' and cohesivity, respectively.

Table 1. Rheologic and physicochemical properties of hyaluronic acid fillers

Product name	Technology name	HA (mg/mL)	G' (Pa)	SwF (mL/g)	DW (mg)	CL (%)	FDA (year)	FDA (approval)
Belotero Balance®	CPM	22.5	41	16.9	48	Variable	2011	Dermal implantation: perioral rhytids
Juvederm Ultra XC®	Hylacross	24	76	9.5	29	6	2006	Dermal implantation: perioral rhytids Lip augmentation
Juvederm Volbella®	Vycross	15	159	3.8	15	-	2016	Lip augmentation, perioral rhytids
Restylane Kysse®	XpresHAN	20	156	7.2	25	7	2020	Lip augmentation, perioral rhytids
Restylane Silk®	NASHA	20	344	2.7	18	1	2014	Dermal implantation: perioral rhytids Lip augmentation

Rheologic properties of FDA-approved hyaluronic acid fillers. Table modified data aggregated from United States FDA reports, table 3 from Rohrich et al.^[5] 2019, Mannino and Lipner^[9], Öhrlund^[10], Fagien et al.^[11]. HA: Hyaluronic acid (concentration); G': elastic modulus; SwF: swelling factor (i.e., hydrophilicity); DW: drop weight (cohesivity); CL: cross-linking; FDA: Food and Drug Administration.

More recent studies, based on Galderma's (Uppsala, Sweden) newest XpresHAN technology, have emphasized the importance of filler flexibility (xStrain)^[10]. Flexibility could be described as shape "memory" after applying increasing amplitudes of dynamic force^[10]. Flexibility is also an objective measure of the force threshold for a filler before it starts to behave more like a liquid than a semi-solid^[10]. Theoretically, higher flexibility could make a filler more suitable for more dynamic areas (i.e., lips). This, however, requires further investigation because G' tends to increase with flexibility when the comparison is made between fillers utilizing NASHA and XpresHAN technology^[10]. Because of this, the clinical differentiation between flexibility and G' needs to be further examined.

Choice of filler for perioral rejuvenation should be based on safety, ease of use, and matching rheologic properties to the appropriate application. The ideal filler for the lips should have a moderate G' and moderate cohesivity, without significant hydrophilicity^[11]. Selecting the optimal filler for each treatment area will be further discussed below, but it is important to remember that the science of matching rheology to clinical practice is still evolving.

VASCULAR ANATOMY OF THE LIP

An intricate understanding of the vascular anatomy of the lips is essential to minimizing vascular complications. The facial artery (FA) crosses over the mandible just anterior to the palpable border of the masseter, before traversing into the perioral region and giving off the superior (SLA) and inferior labial arteries (ILA). Cadaveric data demonstrates the majority (85%) of SLA branch points within a 1.5 cm² area superolateral to the oral commissure^[12]. The height of the SLA branch point is more precisely described as within 5-9 mm of the oral commissure. From there, it courses in a horizontal orientation, with increasing proximity to the vermilion border as it travels medially^[12]. This cadaveric data, on the proximity of the SLA to the vermilion border, is supported by recent clinical ultrasound data that shows the majority of SLAs and ILAs running within the red lip by 1 cm medial to the oral commissure^[13]. Cadaveric data also typified four branching patterns of the SLA and alar artery related to the FA, with the majority of subjects showing either separate branches directly off of the FA (Type I) or the alar artery off of a dominate SLA (Type II)^[12]. Rarely, the SLA is completely absent (Type IV), and perfusion is supplied by the contralateral SLA. The ILA is much more variable, however, typically originating as a common trunk with the labiomental artery. It courses over the alveolar margin of the mandible, initially traversing well below the lower lip vermilion until giving off vertical ascending branches toward the vermilion^[14]. Once in the red lip, it assumes a more

horizontal orientation. Ultrasound data also extended previous understanding of the labial artery depth with 58.5% found in the submucosa, 36.2% intramuscular, and 5.3% were subcutaneous^[13]. The orientation and depth of the artery are important because it is safer to inject superficially (subcutaneous layer) perpendicular to the arterial orientation. Superficial injections also maximize volume enhancement.

TECHNICAL PEARLS (PER SENIOR AUTHOR LDG) *REFER TO VIDEOS 1-5 IN THE ADDENDUM

The most important aspect of any injection consultation is to listen and understand the patient's goals, and then communicate clearly whether or not these goals are achievable. The author do, on rare occasions, counsel patients that their goals are outside my aesthetic, and I will not be able to provide them with their desired outcome. Always remember to clean the lip and perioral area carefully with alcohol [[Supplementary Video 1: "Cleansing"](#)]. Hypochlorous acid is also a good choice for this area and can be used to spray the needle between insertion points.

In general, I consider the following three components when conceptualizing any patient's goals for perioral rejuvenation:

1. Upper lip "red show" (height)
2. Shape
3. Volume

I usually address the patient's desired "red show" first. A superior-to-inferior linear red lip injection technique (a.k.a. "fence-posting" inspired Julie Horne, RN [[Supplementary Video 2: "Vertical Linear Threading"](#)]) is a reliable way to obtain "taller" lips with more red show. I prefer to do this with the patient in a reclined position. I "thread" a 29-gauge needle from vermilion to wet-dry border within the submucosal plane and inject retrograde in tiny amounts as I move back towards the vermilion. I watch as I inject to obtain a smooth line injection. I usually do 3-4 of these lines on each side, working from lateral to medial. I choose an HA with strong cohesivity but also reasonable flexibility (xStrain) for this aspect of lip filler enhancement.

I then sit the patient up and assess for symmetry. For obvious asymmetry, I add small amounts of volume into the body of the lip using a horizontal injection in the submucosal plane [[Supplementary Video 3: "Plumping"](#)]. Additional volume can be added, if needed, using this technique to address five anatomic areas in order: (1-2) bilateral upper lateral lips (with cupid's bow addressed last); (3-4) bilateral lower lip tubercles; and then the (5) central lower lip region. If I am only adding volume, which is more commonly the case in younger patients, I use a strongly hydrophilic HA. However, if I am also attempting to increase the patient's red show, I will use the same filler and the fencing posting technique, as described above, in the same treatment.

For the vermilion and cupid's bow, I add tiny amounts into the rising vermilion to give shape and volume [[Supplementary Video 4: "Defining the Vermillion and Cupid's Bow"](#)]. This can be done along with the entire vermilion, but risks the dreaded "shelf" appearance of the upper lip and must be done with caution.

For the lower lip ([Supplementary Video 5: “Lower Lip Technique”](#); inspired by Vince Bertucci, MD^[15]), I tend to inject in aliquots just deep to vermilion in submucosa in each of the three areas mentioned above. The filler tracks nicely if done correctly and gives a “pout” and structure to the lower lip, which is classically 1.6× the height of the upper lip in an ideal lip.

For mature lips with atrophic and adherent red lips, indicating limited “potential space” in the submucosa, it can be disappointing to find that even large amounts of filler will track posteriorly and not give the desired effect, especially if significant eversion is the primary goal. This must be carefully explained to patients.

I leave at least 0.1 cc of filler before finalizing the result. Patients ice the lip for at least 10 min prior to the final injection. I have the patient look in a mirror to identify any areas of concern for *themselves*. If an early bruise is identified accompanying an asymmetry, I like to point out and express confidence that the end result will be symmetric once the bruise resolves. This final discussion with the patient reduces the risk that the patient will be concerned about issues after the injection and is a good trick for communication.

Post-injection patients are told to expect a 30% reduction in volume related to edema over the following 1-2 weeks; asymmetry may be common and usually resolves, bruising is also explained as well as perceived stiffness and pain which all resolve with time.

ADVERSE EVENTS

The goal of treatment with dermal filler use is to eliminate fine lines and wrinkles and rejuvenate facial appearance temporarily. Unfortunately, as with any medical intervention, complications and adverse events can occur. Complication rates with injections of HA fillers have been reported to be up to 5%^[16]. Fortunately, most adverse reactions are mild and transient.

Adverse events can be grouped into (1) expected procedure-related events, such as bruising, tenderness, and swelling; (2) product-related reactions, including granuloma formation; and (3) technique-related events, such as nodule formation and suboptimal cosmetic results. Potential complications may also be separated by time of occurrence, such as early or late, and severity of the complication^[17-19].

The most common adverse events following the use of temporary dermal fillers are injection site reactions (ISRs) such as bruising, erythema, pain and tenderness, swelling, and itching^[19,20]. These are considered minor complications, usually occur immediately or within hours to days of injection, and routinely resolve within seven days without sequelae. Many patients accept the risk of ISRs with appropriate counseling after a thorough medical history that should include medications that increase bleeding risk, allergies, and previous responses to fillers.

Rare, but more ominous, early-occurring events include immediate hypersensitivity reactions leading to anaphylactic shock^[21], tissue necrosis^[22,23], and even retrograde embolism potentially resulting in stroke or blindness^[24,25]. These rare events can happen to even the most experienced injectors. There is evidence to suggest that certain important precautions and anatomical considerations can reduce the occurrence of these more ominous adverse events. Vascular compromise can be one of the most devastating complications to arise from facial filler injections; this can result from inadvertent intra-arterial embolization of the filler or vascular compression. When injecting the lips, arterial vascular compromise may present with ischemic pallor distal to the side of injection and significant pain. If untreated, this may lead to soft tissue necrosis. If this is identified, warm compress, massage and hyaluronidase should be

considered immediately. Venous vascular occlusion may present with livedo reticularis, which describes venous mottling, and may not present with significant pain. Treatment in this circumstance is similar and involves hot compress, massage, and hyaluronidase. Because of the inherent risks associated with injectable fillers, injectors should keep a “dermal filler safety kit” available in the clinic, and be familiar with steps to reduce prolonged sequelae in the event that symptoms of necrosis develop. The clinical consensus recommends having readily available hyaluronidase and warm compresses^[26].

CONCLUSION

Injectable fillers are an important tool in perioral augmentation and rejuvenation. The use of fillers is becoming widespread and more providers, both physician and non-physician, are incorporating these products into their practices. Fortunately, as the popularity of these products grows, manufacturers are continually developing more diverse filler products so that the injector can match the properties of the chosen filler to the specific treatment region. Additionally, because of the expansion in the number and types of injectors, injection technique and safety education have become paramount to avoiding undesired aesthetic outcomes and feared complications.

DECLARATIONS

Authors' contributions

Made substantial contributions to conception and design of the study and performed data analysis and interpretation: Wick EH, Ostby E, Grunebaum LD

Performed data acquisition: Grunebaum LD

Provided administrative, technical, and material support: Wick EH, Ostby E, Grunebaum LD

Availability of data and materials

Not applicable.

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Conflicts of interest

Grunebaum LD: Allergan consultant - material support, travel, and trainer fees, Galderma consultant - research support. Other authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

All patients provided consent for video and publication.

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