

Review

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Non-surgical (liquid) rhinoplasty

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Abstract

Non-surgical (liquid) rhinoplasty (LR) is a common and expanding cosmetic procedure. The use and safety of in-office injectables, as well as surgeon comfort, has led to substantial growth with the procedure. Knowledge of nasal structural and vascular anatomy, injectable filler properties and in situ behavior, and procedural technique are all required for the application of non-surgical rhinoplasty. There is consensus regarding common indications for the procedure, including dorsal augmentation, correction of post-surgical deformities, and improvement of nasal tip symmetry. However, there is substantial variability in filler usage, technique, and patient selection. As with surgical rhinoplasty, the risk of patient dissatisfaction with LR remains high. It is of utmost importance to consider the rise of non-surgeon providers performing these procedures. A thorough understanding of the risks, benefits, and proper patient selection are key for any facial plastic surgeon utilizing LR.

Keywords: Filler, injectables, rhinoplasty, cosmetic, noninvasive, non-surgical, injection, nose, augmentation

INTRODUCTION

Rhinoplasty has long been considered one of the most technical and challenging surgical procedures. In recent years, non-surgical or “liquid” rhinoplasty (LR) has become increasingly popular as an alternative or adjunct to surgical rhinoplasty^[1,2]. Liquid rhinoplasty typically involves the use of dermal fillers, most



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commonly hyaluronic acid (HA), to augment nasal anatomy and appearance. Advocates and patients generally point to lower costs, convenience, less post-procedural downtime, and the potential for fewer complications as major benefits of the procedure. Among rhinoplasty surgeons, controversy exists with the rise of LR. Discord surrounds the proposed impact of the procedure and the potential poorly described risks. Even so, with the relatively high reported rate of revision rhinoplasty (as high as 15 %), LR has grown to be an important consideration and tool in rhinoplasty practices^[3].

The use of soft tissue fillers for aesthetic purposes has increased drastically in recent years. By 2020, the number of injectable filler procedures had surged to over three million annually, up from fewer than one million procedures in 2000^[4]. Since LR's initial introduction, multiple procedural descriptions and large-volume reviews have been published^[2]. Patient selection and consultation are key in determining patient and provider satisfaction with LR. Most common indications include dorsal hump camouflage, correction of post-surgical bony and soft tissue irregularities, nasal tip augmentation, and correction of side-to-side asymmetries^[2]. A comprehensive systematic review revealed that the majority of publications on LR were from the field of plastic surgery (52%), followed by otolaryngology (22%), dermatology (15%), and oral surgery (9%)^[5]. The goal of this review is not to endorse or recommend against the usage of LR, but to explore its role in the facial plastic surgeon's repertoire.

RELEVANT ANATOMY

A strong anatomic understanding is crucial before undertaking any surgical procedure. Nasal anatomy is complex and sensitive to manipulation. To understand the anatomy of the nose, one may start from the basic bony structure of the midface. The external nose sits atop the pyriform aperture, the bony cavity centered in the midface formed by the frontal process of the maxillae and the nasal bones^[6]. The nasal bones provide the primary structure to the upper one-third of the nose, while several key cartilages provide structure to the inferior two-thirds of the nose. Key cartilaginous structures of the nose include the paired upper lateral cartilages (ULC), lower lateral cartilages (LLC), sesamoid cartilages, and the septal cartilage. The nose is anchored superiorly via the attachment of the nasal bones to the frontal bone, creating the nasofrontal suture (or nasion), while the nasal bones additionally contact the dorsal septum and upper lateral cartilages (at the rhinion or "keystone" area of the nose). Moving superficially, the nose is composed of periosteum/perichondrium overlying respective bone and cartilage, a loose areolar layer, the nasal superficial musculoaponeurotic system (SMAS) (which encases the major mimetic musculature of the nose), subcutaneous tissue, and finally the nasal skin. Skin thickness is an extremely important factor in nasal manipulation, being thickest at the nasion and thinnest at the rhinion^[6,7].

The blood supply of the nose is intricate and is composed of contributions from both the external and internal carotid systems. Terminal blood supply predominantly arises from branches of the facial (external carotid system) and ophthalmic arteries (internal carotid system), and travels within and above the SMAS; therefore, the layers deep to the SMAS are relatively avascular [Figure 1]. These terminal branches are commonly paired and run along the nasal sidewall and tip, although midline vasculature has been relatively well demonstrated^[8]. It is important to remember and note that the associated venous drainage pathways of the nose lack valves, leading to additional risks that will be covered later^[7,9].

FILLER SELECTION

Fillers are injectables meant to alter the volume of a space. Filler material ranges from temporary to long-lasting or even permanent. Typically, fillers with less than two-year duration are deemed temporary. Large reviews demonstrate the most common injectable materials are hyaluronic acid (HA) products, with HA used in an estimated 80% of filler procedures^[3]. HA products include brands such as JUVE \times DERM

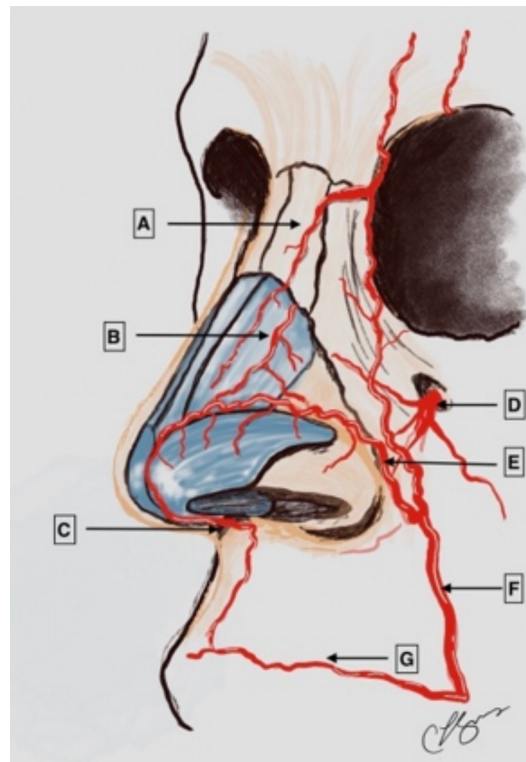


Figure 1. A: Dorsal nasal artery; B: External branch of the anterior ethmoid artery; C: Columellar artery; D: Infraorbital artery; E: Lateral nasal artery; F: Angular artery; G: Superior labial artery.

(Allergan Aesthetics, Irvine, CA) or Restylane (Galderma, Fort Worth, TX). Many classic HA fillers have a typical duration of three to 12 months, although the filler portfolio has expanded to include newer products with a one-to-three-year duration. When placed in the immobile soft tissues of the nose, many of these may have exceedingly longer duration^[10]. Perhaps the second most common filler substance is calcium hydroxylapatite (CaHA), most known as RADIESSE in the United States (MERZ North America, Franksville, WI). CaHA fillers traditionally have a slightly longer duration due to inflammatory-mediated neocollagenesis. In this case, the effects easily last up to 24 months^[11,12]. Other less commonly used fillers included collagen-based products, platelet-rich plasma (PRP), polylactic acid, and autologous fat^[3,13]. Another important factor in choosing fillers is their mechanism of action. Broadly, filler material can be considered volumizing or stimulating. HA and fat alone, for example, provide the volume needed to augment a given space. These are in contrast with stimulating fillers like CaHA, which not only provide immediate volume, but induce an inflammatory response that leads to the deposition of connective tissue and inflammatory byproducts that further aid in tissue filling^[9].

Filler choice is driven by several factors. The first factor should be surgeon comfort with the product. Secondly, one must consider the duration as discussed above. Other considerations of filler choice include the relative viscosity and cohesivity of the product. The ability of a substance to withstand forces and retain shape is measured by the G-prime (G') rating. The higher the G' , the greater the shape retention, the greater the “lifting” capacity of the substance, and the less likely the filler is to spread out in the surrounding tissues. These characteristics allow the surgeon to tailor filler choice to patient specific needs and indications^[11]. Lastly, the side effect profile of each material should be kept in mind, which will be covered in a later section.

Although not a filler, one would be remiss not to discuss the role of botulinum toxin in non-surgical rhinoplasty. Botulinum has been used to successfully and strategically target nasal musculature to alter the cosmesis of the nose. This technique, as an adjunct to filler or on its own, demonstrated statistically significant changes from baseline in nasal augmentation. Typical uses include targeting surrounding musculature to alter the nasal tip, such as the depressor septi or levator labii musculature^[11,14].

INDICATIONS AND PATIENT SELECTION

Patient selection and education are of the utmost importance in performing successful LR. Patients must first understand the indications for LR. These include the correction of dorsal irregularities, aesthetic asymmetries, post-rhinoplasty deformities, tip augmentation, nasolabial augmentation, and even some minor structural issues that impact functional breathing. Each of these is discussed in the following sections^[3].

It is imperative that patients understand that fillers can only be used to add volume, and thus, they are not reductive and cannot reduce the size of the nose. LR cannot straighten or realign the nasal pyramid or septum, though it can provide balance through camouflage and illusion. Even when successful, LR is typically only a temporary solution. The alternative and lasting option remains formal rhinoplasty. LR poses potential risks (discussed below). Perhaps more important than technical indications, one must consider the patient and their expectations. If a patient has unreasonable or unrealistic expectations or is not willing to proceed based on the risks, the procedure should not be completed. Patient satisfaction varies widely with LR, but reports demonstrate greater than 80% satisfaction^[3]. Surveys have shown that patients with more severely significant self-rated nasal defects tend to be less satisfied with their results^[3].

DORSAL IRREGULARITIES

Patients commonly present to a facial plastic surgeon due to dorsal aesthetic concerns. Mild dorsal irregularities have been shown to be a good indication for LR. These mild irregularities may be camouflaged with filler proximal and/or distal to the hump, creating a smoother profile^[3]. Ideal candidates include those with a low radix, midvault saddling, or under projection of the nasal tip^[15]. [Figure 2](#) illustrates the changes in a patient with low dorsal convexity and poor tip support, rotation, and definition before and after undergoing LR.

ASYMMETRY

Nasal sidewall asymmetry is another potential indication. The ideal patient has small irregularities of the midvault, with a concavity or a contralateral convexity involving the upper lateral cartilages or the nasal bones. Injections are typically placed on the concave side to create a more symmetric appearance^[9]. Other small irregularities of the nasal bones or dorsum can also be corrected with small-volume injections to create symmetry.

POST-RHINOPLASTY DEFORMITIES

As mentioned previously, there are substantial rates of revision following open rhinoplasty. Opting for a revision rhinoplasty is a significant decision for patients, as it involves associated costs, psychological impact, loss of work and productivity due to surgical recovery, and the prolonged healing period of the nose. Indications include mild dorsal saddle formation and inverted-V deformities. It is important to consider nasal valve support in these patients as well. If a patient has remaining septal support with good valve support, they may be a candidate for injection. Small residual deformities can be addressed to create a smoother aesthetic result. Pollybeak deformity may also be addressed with dorsal injections for blending,

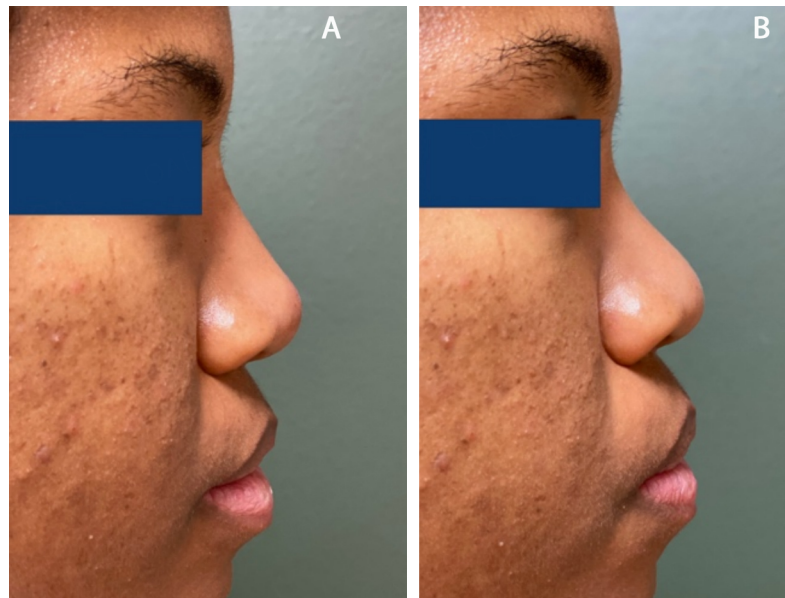


Figure 2. Profileplasty and the aesthetic dorsal lines: Injection augmentation to minimize the impact of a low dorsal convexity and improve tip rotation, support, and definition. (A) Initial presentation, (B) Post-Injection augmentation

followed by a small amount of infradomal injection to increase rotation^[15].

TIP AUGMENTATION

The aesthetic impact of the nasal tip is well-known among rhinoplasty surgeons. Even extremely small tip irregularities can lead to substantial aesthetic concerns. Filler in the nasal tip can be a useful adjunct. Commonly, filler may be used to address small minor tip irregularities. Tip projection may be slightly increased with small injections in the domal area, and tip rotation may also be increased by injections in the infradomal area, correcting any slight under rotation. In addition, both can be enhanced along with overall tip support with injection in the columella between the medial crura of the lower lateral cartilages. Minor alar retraction may also be camouflaged with small injections^[15].

NASOLABIAL AUGMENTATION

The nasolabial angle and columella have a significant impact on nasal aesthetics, especially from the profile. Filler may be used to augment the nasolabial angle directly. By injecting the nasal tip, the relative nasolabial angle and apparent length of the columella may be augmented. Additionally, injecting the columella can be useful for the addition of tip support and anteroinferior placed volume can reduce the appearance of a retracted columella^[9,15].

FUNCTIONAL

A more recent expansion for LR is its potential application for breathing. Rhinoplasty surgeons are familiar with the internal nasal valve and its importance in airway resistance. Several authors have advocated the injection of filler between the ULC and dorsal septum, thus acting as a pseudo-spreader graft and increasing the valve angle, to improve breathing. Additionally, filler may be placed in the scroll region or sidewall to strengthen the internal valve. Similarly, injections in the ala may strengthen some external valve deficiencies^[16].

PROCEDURAL TECHNIQUE

Like all procedures, LR technique goes hand in hand with a thorough understanding of nasal and facial anatomy along with aesthetic norms relevant to gender, age, ethnicity, and patient preference. Various procedural techniques have been published, each with variable risks and benefits. The volume of filler used varies widely by study, although less than one milliliter (mL) is most reported, with an average of 0.54 mL used for each LR procedure. All the reported studies included injections performed by physicians^[5]. The ideal location for injection of filler in the nose is deep to the vascular-rich SMAS, in the supraperisoteal or supraperichondrial plane [Figure 3]. Specifically, when addressing the nasal tip, some studies have recommended more superficial injections. Additionally, injections in the midline are typically preferred due to the paired and more laterally positioned vasculature^[5,10]. However, as discussed above, midline injections are not always free of vasculature^[8]. Specific technique varies based on the desired effect and patient exam. Variations in technique include the usage of needles (ranging from 22 to 30 gauge) or injection cannulas. Needle and cannula size are often dictated by the filler chosen for LR^[17,18].

First, informed consent and patient photos are obtained. The patient is positioned in a seated or semi-recumbent position with the head elevated. Skin is prepared with an antiseptic. The authors prefer alcohol followed by topical application of 4% chlorhexidine gluconate. Local anesthetic may be injected, though we generally avoid this to prevent alteration of tissue planes that may distort the areas of desired augmentation. Most commercial fillers in the United States include lidocaine, which reduces patient discomfort during injection. In addition, topical anesthetic creams can be used if desired. In rare cases where greater local anesthetic effect is needed, peripheral nerve blocks may be utilized, provided they are administered at a distance from the area of augmentation for the same purposes. The authors then use the non-dominant thumb and forefinger to compress the venous structures adjacent to the site of augmentation. Compression may also aid in distraction and pain relief for the patient. Next, the needle or cannula is inserted distal to the desired site, while injecting small droplets or linear threads using a retrograde technique. Other variations include direct, perpendicular injection of small aliquots into the deficient site^[19].

Withdrawing the needle to avoid vasculature before injection is a common practice, although its application can vary^[5]. Several studies have presented specific placement techniques, such as the “Diamond Injection”, “Deep Columellar Approach”, and “Five Point”. These methods generally report positive patient satisfaction and good safety profiles^[17,18,20].

COMPLICATIONS AND PITFALLS

No procedure is without risks and potential complications. Although LR is technically a non-surgical procedure, it still carries risks that can have devastating impacts. It is crucial to thoroughly review these risks with patients to ensure they fully understand them. Among studies reporting risks associated with LR, the complication rates are roughly 2%. Of note, although large systematic reviews have been completed, they may be biased. This is because the studies included in these reviews are typically larger, whereas major LR complications are typically reported as case reports^[5].

Most of the risks associated with LR are minor. These typically include skin erythema or ecchymosis and associated tenderness at the injection site. These findings are typically self-limited. Small nodules or irregularities may develop from the filler itself, which may require additional injection, massage, or filler dissolution. Another known adverse effect of superficial HA placement is the formation of a bluish hue beneath the skin at the injection site (known as Tyndall effect)^[9].

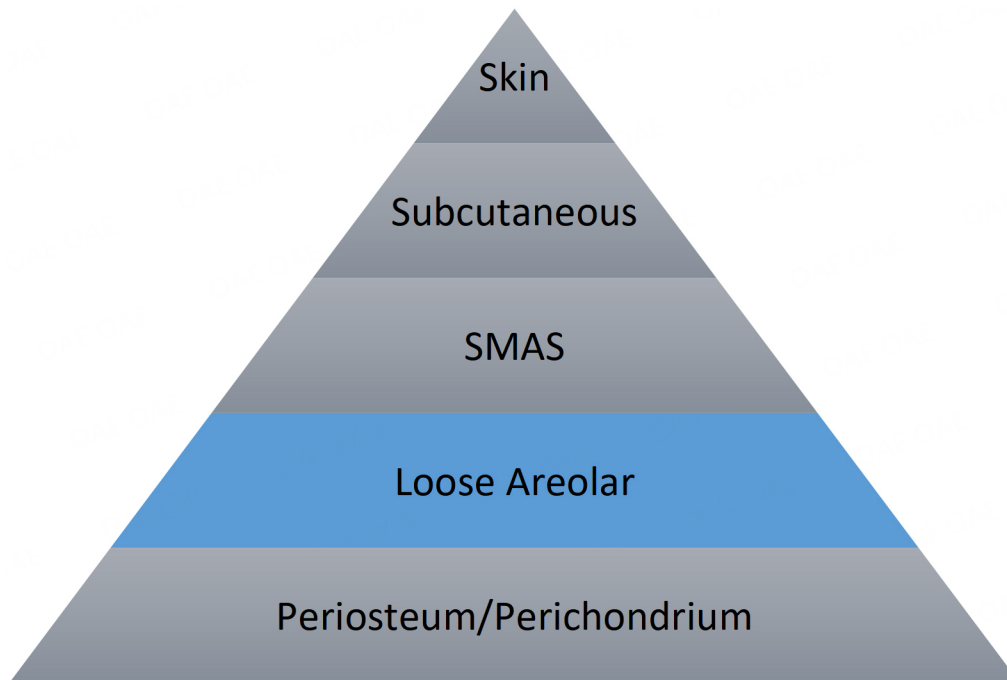


Figure 3. Demonstration of nasal layers, in which injection location is illustrated with blue highlight. SMAS: superficial musculoaponeurotic system.

More severe complications include infection, local site reaction, and even vascular compromise. Of the reported infections, all were managed and resolved with antibiotics. Of note, all reports occurred in CaHA injections^[5]. Even so, HA infections are known to occur elsewhere in the face and are a potential nidus of infection in the nose as well. If infection occurs, the filler may serve as the foreign body for biofilm formation and may even sequester the infection from the vascular supply needed for delivery of antibiotic agents. Thus, enzymatic filler breakdown is often warranted. The most serious and concerning risk of filler injection in the face is vascular compromise, which can result in severe skin necrosis or potentially blindness. Skin necrosis may develop due to intraarterial injection or from compression of vessels by filler, which deprives local tissues of vital blood supply. Management of vascular compromise includes administration of topical nitroglycerin paste, oral aspirin, and injection of hyaluronidase in and around the filler injection site. Blindness can occur due to intraarterial injection with retrograde arterial embolism to the ophthalmic and retinal arteries. Management is varied but commonly involves retrobulbar hyaluronidase injection. Any sign of vascular compromise (including skin blanch, severe localized pain, visual changes, eye/tooth pain, and headache) should result in immediate termination of the procedure. Among filler-related intravascular complications, most are reported with glabellar or midface injections, as opposed to LR. Volumetric anatomic studies determined the injection volume necessary to reach the orbital apex. The volume is reported as roughly 0.085 mL; thus, the author's recommendation is to limit individual filler aliquots to less than 0.1 mL for each administration^[5,9,21].

One definite advantage of HA products is the availability of hyaluronidase, an enzyme that hydrolyzes the bonds between HA molecules, facilitating their breakdown. This is useful for adjusting excess volume after aesthetic injections and for treating nodules. Additionally, hyaluronidase is essential for addressing potential vascular complications mentioned above. Therefore, all injectors must have hyaluronidase readily available and be well-acquainted with its dosing and administration. Interestingly, some data suggest that hyaluronidase may also affect non-HA fillers^[5,9].

CONCLUSION

The indications, popularity, and use of LR have increased dramatically in the last two decades. For a well-rounded facial plastic surgeon, understanding this topic is crucial due to its relevance to patient interest and its role as a useful clinical adjunct. While liquid rhinoplasty serves as a valuable tool, it does not replace or diminish the importance of open rhinoplasty. Additionally, it may be utilized by non-facial plastic surgeons, potentially increasing risks for patients who may not be fully aware or informed of surgical rhinoplasty alternatives.

DECLARATIONS

Authors' contributions

Made substantial contributions to the conception and design of the review and interpretation: Erwin DZ, Stallworth CL

Provided administrative, technical, and material support: Erwin DZ, Stallworth CL

Availability of data and materials

Not applicable.

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Conflicts of interest

All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

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