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## Cannula versus needle in medical rhinoplasty: the nose knows

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#### Abstract

The use of hyaluronic acid (HA) fillers has become a popular alternative for nose remodeling, although poor understanding of the nasal anatomy has resulted in adverse events and generated some controversy. Among them, is the question of where and when to use cannulas vs needles. Through multiple cadaver dissections, clinical experience and the review of medical literature the authors conclude the use of needle over cannula is preferred, assuring a correct injection plane lying fully against the bone or cartilage. Although blunt in nature, cannulas may lead to difficulty in determining with precision the exact depth of product placement and contribute to more dissection of adjacent structures. Thorough knowledge of the highly variable nasal anatomy, including vessel depth location is of outmost importance in avoiding adverse events. Good patient selection is critical where most noses for augmentation rhinoplasty and some reduction rhinoplasty candidates where the goal is to camouflage the dorsal hump are amenable to medical rhinoplasty, unless there is reduced skin elasticity of nasal soft tissues or distortion of anatomy from surgery or trauma. Appropriate product selection is important for effective results. The authors suggest fillers with low cohesivity and high lifting capacity. Finally, we suggest a technique referred as Rhinosculpting base in the use the use of three conceptual elements: facial analysis, light reflection, and use of HA gel as a cartilage graft, in combination with the detailed injection technique presented in this article, which ensures a safer and satisfying treatment outcome.

#### **KEYWORDS**

filler, hyaluronic acid, nasal anatomy, non-surgical, rhinoplasty

#### **1** | INTRODUCTION

Rhinoplasty is a common procedure performed in the field of medical aesthetics.<sup>1</sup> While surgical rhinoplasty remains the gold standard approach for the reconstruction or correction of the nose,<sup>1</sup> surgeons are increasingly resorting to the use of hyaluronic acid (HA) fillers for both primary and revision rhinoplasties, as such methods are minimally invasive, and provide an immediate result thus making it a very attractive option for patients.<sup>2</sup>

Rhinoplasty utilizing HA fillers is a procedure which is known to sculpt and contour the nose but can also smoothen out and camouflage asymmetries and contour nasal irregularities. However, the use of fillers has generated some controversy due to the occurrence of severe adverse events, especially those of a vascular nature.<sup>3</sup> Most adverse events associated with this procedure are due to poor understanding of nasal anatomy compounded by the inability to predict the exact location of blood vessels. In this publication, we attempt to ascribe criteria for the selection of cannulas vs needles as part of medical rhinoplasty techniques that prioritize safety and efficacy.

### 2 | NASAL ANATOMY

Injecting fillers into the nose can only be successful when the patient's face is adequately evaluated and the characteristics of the nose including, the nasal skin, soft tissue, cartilages, and bony anatomy are carefully assessed.

The soft tissue of the nose consists of five layers above the bone: skin, superficial fatty layer, fibromuscular layer (SMAS: superficial musculoaponeurotic system), deep fatty layer, and the perichondrium/periosteum. In the lower dorsum, arteries run adjacent to the fibromuscular and deep fatty layers. In contrast, arteries of the upper dorsum are present at the superficial fatty layer, immediately above the fibromuscular layer.<sup>6</sup> A recent study<sup>7</sup> mapping the dorsal nasal artery found that it ran downward  $20.3 \pm 3.5$  mm from the intercanthal line with a communicating branch that connected both dorsal nasal arteries when present. Since the superficial musculoaponeurotic system is rich in blood vessels,<sup>7</sup> filler must be placed on the periosteum-perichondrium to avoid vascular injury. Vessel depth is more critical than identifying the exact location of nasal vessels. Furthermore, when the filler is not injected below the SMAS layer in the nasal dorsum, the filler can be visible, palpable, or both<sup>2</sup> especially in thin-skinned patients.

The injection technique is further dependent on nasal shape. For a flat nose, the injection plane of the filler when using a cannula should be at the level of the supraperiochondrial and supraperiosteal layer, and the entry point of cannula should be at the infratip lobule (Figure 1, cadaver photograph). For a hooked nose, dual injection technique should be recommended using the cannula and needle.<sup>7</sup>

According to Moon et al., the safest layer for filler injection in the nose is the deep fatty layer, which is located between the SMAS and the perichondrium or periosteum.<sup>8</sup> The authors would emphasize that the only way to be sure injectors are placing filler onto this layer, is to directly inject on bone and/or cartilage, given the deep fatty layer's thickness is minimal.

## 3 | VASCULAR ANATOMY

As mentioned above, any cosmetic procedure in the nose, be it surgical or with injections, requires a thorough understanding of nasal anatomy in order to avoid adverse events. Vascular nasal anatomy of the external nose tends to be highly variable between patients and is often asymmetric. The most severe complication of nasal injections is the development of vascular embolisms which can lead to nasal skin necrosis and even blindness.<sup>3</sup> According to Bertossi et al,<sup>9</sup> the areas with the highest danger are the areas of confluence of the internal and external carotid arteries. Two main trunks irrigate the external nose: the facial artery and the ophthalmic artery. The ophthalmic artery is a branch of the internal carotid artery; it supplies blood to the lower nasal dorsum through the dorsal nasal artery, one of its terminal branches. The facial artery is a branch of the external carotid artery; the angular and superior labial arteries are derived from the facial artery, and they supply blood to the lower part of the nose. The angular artery gives rise to the lateral artery and courses in a cranial direction and in the naso-optic groove it diverges into several branches along the nasal dorsum and cheek where it



**FIGURE 1** Cannula entry point. Most used cannula entry point at the infratip lobule. Note that it will be difficult to know exactly above what layer we are entering

can communicate with a branch of the infraorbital artery. The superior labial artery gives rise to the columellar artery that supplies the columella and the nasal tip and communicates with the angular artery.<sup>7,8,10</sup> According to Rohrich et al, most of the nasal tip vascular supply is provided by the lateral nasal artery.<sup>11</sup> The columellar artery was highly variable being present bilaterally in 9% of the cases, unilaterally in 68%, and absent in 23%.

#### 4 | ADVERSE EVENTS

The risk of an adverse event exists in all cases. Filler-related adverse events include technical errors in terms of volume and/or depth of injection and product selection.<sup>5</sup> In addition, previous rhinoplasty can lead to an increased risk of vascular complications, given that the anatomy may be significantly modified from scarring/fibrosis and repositioning of the tissues and vessels.<sup>5</sup>

#### 5 | PATIENT SELECTION

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Most noses with a low dorsum are amenable to medical rhinoplasty, as well as some reduction rhinoplasty candidates where the goal is in camouflaging the dorsal hump, in general limited by the nasofrontal angle, rarely more obtuse than approximately 135°.

Local tissue reasons for excluding patients from augmentation rhinoplasty include reduced skin elasticity of the nasal soft tissues from previous procedures leading to fibrosis and/or the tension nose.<sup>4</sup>

#### 6 | INJECTABLE FILLERS

Hyaluronic Acid (HA) is a suitable material to use in the nose because, as a naturally occurring glycosaminoglycan disaccharide found in the skin, it is also biodegradable and biocompatible.<sup>12</sup> Over the course of the last decade, HA and calcium hydroxyapatite (CaHA), the two most common injectable fillers of the nose, have been applied to correct tip, dorsum, and columellar deformities.<sup>13</sup> Importantly, hyaluronidase, an enzyme that breaks down HA makes injections of the nose easily reversible with a low risk of allergic reactions. Silicone should be avoided in nasal injections due to a higher risk of adverse effects, such as granuloma formation and infection.<sup>2</sup>

An important aspect to consider when using HA fillers are the rheological properties, its lifting capacity or G' (materials with a higher G' are more resistant to deformation than those with a lower  $G'^{12}$ ), and its cohesivity (the capacity of the product to integrate into the surrounding tissue). In the case of augmentation rhinoplasty, a lower filler cohesivity is desired to avoid integration of products into the surrounding tissue which would decrease the initial height achieved from product placement. This integration will further lead to widening of the nasal dorsum as the vertical height decreases. Hyaluronic acid fillers with low cohesivity levels achieved and maintained better nose definition and projection.

Aesthetic physicians should also note that the addition of lidocaine with epinephrine leads to vasoconstriction and can thereby prevent early detection of blanching due to vascular injury while procedures are being carried out.

#### 7 | CANNULA VERSUS NEEDLE INJECTION

There has been a long-lasting debate among aesthetic practitioners regarding their preference of using cannulas or needles in nasal rhinoscuplting. As noted previously, one of the senior authors (FR) prefers the use of the needle since it allows the operator to inject HA more precisely and accurately.

When filler is injected with a cannula, a supraperiosteal plane cannot be assured, especially with a single distal entry point. A study carried out by the authors in cadaveric specimens found that when injecting HA into the bony pyramid with a cannula, HA was found repeatedly in the superficial fatty layer (data on file). It is difficult and unlikely to maneuver the cannula to the level of the periosteum using a distal entry point as the cannula tip cannot glide over the proximal hump to reach the periosteum and consequently curves away from the bone. This has led some to incorrectly claim it is a more precise technique.<sup>14</sup> Furthermore, when HA was injected with a cannula into the nasal infratip, it was found repeatedly below the cartilage, whereas tip projection requires HA to be deposited above the cartilage.<sup>15</sup> This latter technique is hampered by the concavity of the radix area of the nasal bone, which in turn can be a major cause of adverse vascular events. It should be noted that in additional cadaver studies although filler was thought to be injected in a supraperiosteal layer, it was in fact deposited in the superficial or fibromuscular layers,<sup>15</sup> given the inability to reorient a cannula onto the periosteum when using a distal to proximal injection technique.

On the other hand, using cannula could result in less bruising.<sup>16</sup> See Figures 2-4, for examples of cannula and needle usage (cadaver photographs).

The safety associated with cannula use needs to be explained. Although it is blunt in nature, large bore cannulas may dissect tissues more than a needle, which results in the destruction of connective tissue, that when intact serves as a wall to contain the product. Furthermore, the distance from entry point to product deposition leads to an unnecessary dissection of several centimeters of nasal tissue. This further leads an element of distortion while inside the nose, making the precise deposition of product difficult. Depending on the depth of cannula placement and the angel of entry, the tip of the cannula is sometimes not palpable again modifying the desired plane of product placement. Furthermore, smaller gauge cannulas can still enter vessels.

## 8 | RHINOSCULPTING CONCEPTUAL ELEMENTS

The three primary elements leading to the improvement of augmented rhinoplasty using HA fillers are as follows:

- 1. Angles, ratios, and proportions (facial analysis)
- 2. Light reflection.
- 3. Considering the HA filler as a cartilage gel and substitute for a cartilage graft.

Collectively, the use of these conceptual elements plus the detailed injection technique is called Rhinosculpting by the authors.

# 9 | ANGLES, RATIOS, AND PROPORTIONS (FACIAL ANALYSIS)

Individualized facial analysis can be carried out by dividing the face into horizontal thirds and vertical fifths. The nose represents the **FIGURE 2** A, Placement of cannula in the presence of dorsal hump. B, Correct positioning of cannula to approach the nasion



middle third in the horizontal division and one-fifth of the vertical division. The brow-tip line dictates the ideal shape of the nose and helps the operator detect contour irregularities such as a dorsal concavity or convexity. In addition, the alar base should have the width of the intercanthal distance.

The nasofrontal angle should be 130°-138° and encompasses the glabella and the radix, with the nasion representing the deepest portion of the angle.

The ideal radix length is 9-14 mm, where a low radix gives the appearance of a short nose and a dorsal pseudo hump. The basal view of the nose is also divided into thirds, with a ratio 2:1 between the columella and lobule. It should also be noted that the above angles and ratios may vary in the different ethnic groups.<sup>17</sup>

Before treating the nose surgically or with fillers, two concepts must be well addressed. These are tip projection and tip rotation, and each is necessary to achieve a good tip definition. According to Kridel,<sup>18</sup> tip projection refers to the posterior to anterior tip distance extending from the facial plane at the alar crease, while tip rotation is defined as a movement of the tip that extends it upward or downward in relation to the naso-labial angle, changing the nasal length and columella inclination.

## 10 | LIGHT REFLECTION

Light reflection is a protagonist in this technique and will help to identify the tip lobules; when light is not reflected, the nasal tip is flat and when light is reflected it indicates that the nasal tip is well defined. Light might be reflected to one lobule at the expense of the other, therein signifying asymmetry. Finally, if light loses its continuity, there is a nasal deformity, for example, in a saddle nose. In addition, convex surfaces reflect light while concave surfaces retain it. It is therefore important to note that when changing the surface from a concave shape into a convex shape, this will reflect light.

## 11 | CONSIDERING HA FILLER AS A CARTILAGE GEL AND SUBSTITUTE FOR A CARTILAGE GRAFT

At a conceptual level, we view HA as a cartilage-like gel instead of real cartilage grafts. With this consideration of HA as a cartilage gel, we are applying surgical concepts that have been used in surgical rhinoplasty for more than a 100 years. This is the reason why the previous section of the proportions and angles of the nose have such an importance. The injector must evaluate, for example, if the tip needs support, then the HA should be placed like a cartilage strut, or if the tip requires more definition, then HA is used as a cartilage shield. For these purposes, it is paramount to use a HA with high lifting capacity and low tissue integration.

Two key considerations for the use of HA as a cartilage graft are as follows:



- 1. The layer in which the product is injected; in all cases, the layer should be deep, on top of the periosteum on the bony vault and a close as possible to the perichondrium in the rest of the nose.
- 2. The injector must create an enclosing wall which can be done with the fingers placed in parallel with the long axis of the nose with the product injected slowly inside that space. The most important hand is the one that is enclosing the product.

## 12 | INJECTION TECHNIQUE

The various rhinoplasty techniques of injection of HA filler are linear threading and serial puncture. Here we present the FR's technique, which is based on his clinical experience and has been tested in cadaveric specimens.

The difficulty inherent in filler rhinoplasty does not stem from the fact the product must be applied in the different layers of the nose, but rather due to what is under the layers, that is bone, cartilage, or mucosa. Thus, if the operator is injecting HA into the layer above the periosteum, it is relatively easy but injecting in layers above the perichondrium presents additional challenges.

The authors have found that a good way to increase the probability of the product being at the right layer is to compensate for the needle beveling so it can lay as flat against the bone (or cartilage) as possible. In the case of the product used by the authors, the needle provided in the original packaging is a 29 gauge with a 15-degree bevel. Therefore, the needle must be angled quite close to being parallel to the skin. This will theoretically prevent "backflow" of the product to other layers and pinning an artery to the bone.<sup>19</sup>

Additionally, we agree on the following consensus points for injection safety<sup>20</sup>:

- 1. Assess skin mobility followed by a slow injection technique with low extrusion pressure.
- 2. Cannulas are not considered safer for nasal injection.
- 3. Micro-boluses should be injected in small aliquots (<0.1 mL)



**FIGURE 4** Correct filler placement on top of nasal domes (perichondrium) to achieve nasal tip projection using a needle

(A)

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**FIGURE 5** Rhinosculpt results on a 25-y-old female patient with dorsal hump and lack of tip support



4. Move the needle in the chosen plane at all times when delivering micro-boluses, even if only in small amplitude movements.

The operator can manipulate the nasion superiorly or inferiorly with filler leading to either a shorter or longer nose, respectively. Once the fronto-nasal angle is established, the operator can then continue with the camouflaging of the hump. A first point is selected to increase the dorsum height. This convex point will create some concavity and shadowing below it. The next step is to convert this concavity into a convexity and so on until the injections reach the area of the supratip. The hump is normally not injected. Again, a high G prime, low cohesivity product is preferred. To confirm uniformity and symmetry, two straight light reflection lines should be seen on each side of the dorsum in continuity. Once the dorsum height is established, the tip rotation and projection can be adjusted. Tip rotation is achieved by correcting the naso-labial angle. Placing HA filler on top of the nasal spine will increase the angle. The last steps are aimed at adjusting the tip projection in the following manner:

- 1. Product is placed under the feet of the medial crura.
- 2. As discussed above, HA is used as a cartilage strut between both medial crura.
- Depending on the need for tip projection and/or definition, HA is applied as a shield graft, overlay graft, or both.

Small grafts in the right layer can have a profound effect on contour. We recommend the precise placement of the product as an on-lay graft at the tip, cartilage strut at the columella, or directly on the dorsum of the nose. See Figure 5, for result.

### 13 | CONCLUSION

Injection technique for rhinoplasty will directly affect both aesthetic outcome and safety. Following careful patient assessment, understanding nasal anatomy and creating treatment goals lead to successful outcomes. Injections should be undertaken slowly using small volumes with a needle for precise placement in the correct layer. The injector must be well educated in nasal anatomy and product characteristics of HA fillers, aiming for low cohesivity and high lifting capacity, and incorporating a thorough facial analysis of angles, ratios, and proportions, using light reflection to confirm uniformity of the HA gel as a cartilage graft. Respecting the particularities of nasal anatomy, the choice is clear in technique selection.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, FR, upon reasonable request.

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