Filler Rhinoplasty Evaluated by Anthropometric Analysis

Sung Hwan Youn, MD* and Kyle K. Seo, MD, PhD*†

BACKGROUND There are no reports of objectively evaluating the efficacy of filler rhinoplasty by anthropometric techniques.

OBJECTIVE To objectively demonstrate the effectiveness of filler rhinoplasty by anthropometric analysis.

MATERIALS AND METHODS A total of 242 patients who revisited the clinic within 2 months of undergoing hyaluronic acid filler rhinoplasty were analyzed based on the injection site, injected volume, and the change in anthropometry.

RESULTS Among the 242 patients, 112 (46.3%) were in the nasal dorsum augmentation group, 8 (3.3%) were in the tip rotation group, and 122 (50.4%) were in the whole nose augmentation group. Average injection volume was 1 ± 0.4 mL for nasal dorsum and 0.9 ± 0.3 mL for tip rotation, whereas 1.6 ± 0.5 mL was used for whole nose augmentation. On follow-up, the radix height, nasofrontal angle, and nasolabial angle (NLA) had increased by 78.3%, 5.7 ± 4.1°, and 9.4 ± 4.5°, respectively, whereas the modified nasofacial angle had decreased by 1.9 ± 2.9°. Three cases (1.2%) of vascular complications were encountered.

CONCLUSION Filler rhinoplasty is a simple and effective treatment modality producing outcomes comparable with surgical augmentation rhinoplasty. Among various anthropometric measurements, the nasal radix height was the most useful for evaluating dorsum augmentation, whereas the NLA was the best for nasal tip rotation.

The authors have indicated no significant interest with commercial supporters.

The nose has an aesthetically profound effect on the overall facial balance by representing the central feature of the face.[1] Accordingly, reshaping a flat, poorly defined nose can refine the facial contour and enhance the overall appearance. The potential benefits of rhinoplasty are particularly significant for the Asian nose with a short nasal length, flat radix, underprojected or blunt nasal tip, and short or recessed columella; the combined result of which is a smaller and less pronounced nasal profile compared with that of the Caucasians.[2–4] Naturally, surgical rhinoplasty has enjoyed huge popularity in Asia for many decades. Filler rhinoplasty, being a quick and simple procedure involving no social downtime while delivering results comparable with surgical augmentation rhinoplasty, has emerged as a compelling option for those who prefer noninvasive procedures or who are afraid of undergoing surgery.[2]

However, there were no reports objectively analyzing the efficacy of the filler rhinoplasty in the literature. As such, this study was conducted to objectively evaluate the efficacy of filler rhinoplasty by anthropometric analysis.

Materials and Methods

Subjects (n = 242)

The medical records of 366 patients who received hyaluronic acid (HA) filler rhinoplasty at the "Modelo Clinic" from 2006 to 2014 were retrospectively reviewed. Then, the records of 242 patients who made follow-up visits within 2 to 8 weeks of their treatment

*Modelo Dermatology Clinic, Seoul, Korea; †Department of Dermatology, Seoul National University, College of Medicine, Seoul, Korea

ISSN: 1076-0512 • Dermatol Surg 2016;42:1071–1081 • DOI: 10.1097/DSS.0000000000000832

were selected. All patients provided written informed consent for the procedure.

Subgroups and Filler Injection

Patients were divided into 3 groups based on the injection site, namely, the nasal dorsum augmentation group, the tip rotation group, and the whole nose augmentation group. Meanwhile, patients requiring nasal hump correction were also assessed independently by grouping.

In nasal dorsum augmentation, fillers are placed primarily at the nasal dorsum extending from the radix to the nasal tip. In some cases, fillers are concurrently injected into the glabella-to-radix region to create an arch-shaped transition extending from the eyebrow to the dorsum. For nasal tip rotation, fillers are injected mainly into the columella and around the anterior nasal spine at the nasolabial junction. Meanwhile, tip augmentation is performed only where necessary to improve the nasal tip projection. For each group, the volume of fillers injected in the respective sites was also assessed.

As regards the types of HA fillers injected, 238 among the 242 (98.4%) cases were performed using Restylane (particle-type HA filler [PHA], 81% using a combination of Restylane SUBQ and Restylane, and 17.4% using Restylane only), whereas others were performed using Juvederm Ultra (gel-type HA filler [GHA]). Fillers were injected with a 23-gauge cannula into the deep subcutaneous layer, more specifically, the supraperiosteum layer using the retrograde threading technique.[2] A 30-gauge needle was used for making any subsequent fine corrections.

Concerning anesthesia, 0.1 mL of 2% lidocaine with 1:100,000 epinephrine was injected subcutaneously per site, for nasal dorsum augmentation at the radix, the rhinion, and the infratip lobule. In the case of nasal tip rotation, local anesthetic was injected at the columella and the nasolabial junction. In addition, topical anesthetic cream was applied for needle injection if necessary.

Clinical Photographs and Anthropometric Analysis

Five standard clinical photographs (i.e., frontal view, both 45° views, and both lateral views) were taken for each patient in identical positions. Only the lateral views were used, however, for anthropometric assessment.

Regarding anthropometric factors, the authors selected the nasofrontal angle (NFrtA), modified nasofacial angle (MoNFcA), and the radix height increment (%) (RHI) to evaluate the efficacy of dorsum augmentation with fillers and the nasolabial angle (NLA) to assess the effectiveness of nasal tip rotation.

By definition, the NFrtA reflects the angle between the nasal dorsum line and the glabella line. The nasofacial angle (NFcA) represents the angle between the nasal dorsum line and the glabella-to-pogonion line.[2] Considering that the glabella-to-pogonion line is subject to change in case the patient underwent any forehead and/or chin augmentation, the authors chose instead to adopt the line perpendicular to the Frankfurt horizontal line (PFHL) as in Figure 1.[5–8] The authors then designated the resulting angle between the nasal dorsum line and the PFHL as the MoNFcA. Meanwhile, the NLA represents the angle formed by the line tangent to the columella intersected by the subnasale-to-labial limb line[2,7] (Table 1).

For assessing nasal radix augmentation, the authors measured the distance between the radix and the line parallel to the PFHL drawn at the anterior margin of the lower eyelid before and after treatment, and subsequently calculated the rate of increase (%) (hereinafter RHI [%]) (Figure 1). To assess the efficacy of nasal hump correction, the authors measured the angle between the nasal dorsum line intersected by the rhinion-to-nasal tip line, referring to this angle as the rhinion angle (RA).

Each anthropometric measurement was taken using the Adobe photoshop 7.0.1 (Adobe Systems Inc., CA), digital protractor, and the pixel ruler program. The authors then compared the relevant anthropometrical

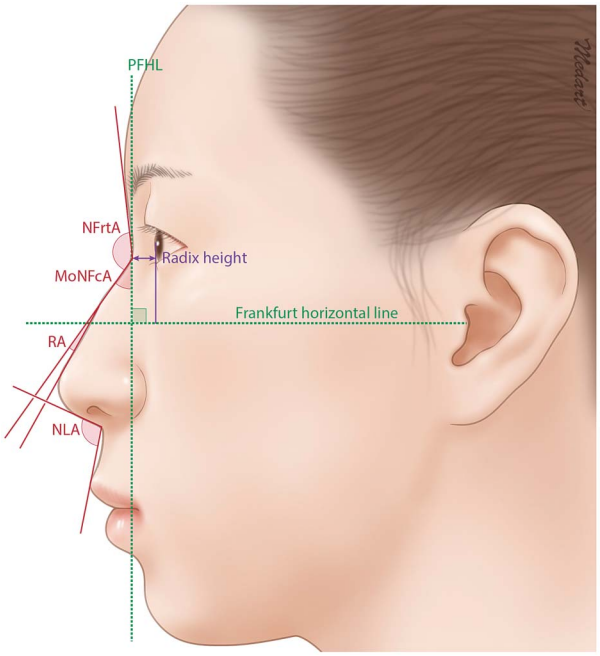

Figure 1. Anthropometric measurements for filler rhinoplasty (Reproduced by permission of Seo KK. Filler for Asians. Jeju:Seoul Medical; 2016.)

factors pretreatment and posttreatment to objectively establish the efficacy of filler rhinoplasty.

Statistical Analysis

Paired *t*-test was performed to compare the anthropometric factors pretreatment and posttreatment. For statistical analyses, SPSS version 17.0 (SPSS Inc., Chicago, IL) was used and p values <0.05 were considered to be significant.

Results

Demographics

Two hundred twenty-one of the 242 patients (91.3%) were female. The mean age of patients was 31 ± 9 years. By age group, most patients were in their twenties (116 patients or 47.6%) and thirties (74 patients or 30.6%), whereas 9.5% (23) were in their teens, 7.9% (19) in their forties, and 4.1% (10) in their fifties or above.

Injection Site and Volume

One hundred twelve patients (46.3%) underwent nasal dorsum augmentation, whereas the tip rotation group consisted of 8 patients (3.3%), and the whole nose augmentation group consisted of 122 patients (50.4%). Of the 242 patients in total, 25 patients (10.3%) received hump correction. The average injection volume was 1 ± 0.4 mL for nasal dorsum augmentation, 0.9 ± 0.3 mL for tip rotation, and 1.6 ± 0.5 mL for whole nose augmentation (Table 2). By specific subsites of injection, the average injected volume was 0.3 ± 0.2 mL for the glabella-to-radix area, 0.8 ± 0.4 mL for the nasal dorsum, 0.4 ± 0.2 mL for the nasal tip, and 0.7 ± 0.3 mL for the columella-nasolabial junction, respectively.

Comparison of Anthropometric Factors Preinjection and Postinjection

The NFrtA, the MoNFcA, and the RHI were measured and compared before and after treatment in the nasal

TABLE 1. Anthropometric Factors for filler Rhinoplasty

Indication	*Anthropometric Factors*	*Definition*
Nasal dorsum augmentation	NFrtA	Angle between the nasal dorsum line and the glabella line
	MoNFcA*	Angle between the nasal dorsum line and the line perpendicular to the PFHL
	RHI (%)*	Radix height is the distance between the radix and the line parallel to the PFHL drawn at the anterior margin of the lower eyelid. RHI (%) was calculated postinjection.
Tip rotation	Nasolabial angle	Angle between the line tangent to the columella and the subnasale-to-labial limb line
Hump correction	RA*	Angle between the nasal dorsum line and the rhinion-to-nasal tip line

*Newly developed by the authors for this study.

TABLE 2. Average Volume Injected per Subsite

Subgroup	Number (%)	Average Volume (mL)				
		Glabella-to-Radix Area	Nasal Dorsum	Tip	Columella- Nasolabial Junction	Total
Nasal dorsum augmentation	112 (46.3)	0.3 ± 0.2 (0.1~0.8)	0.8 ± 0.4 (0.2~2)	0.4 ± 0.2 (0.1~0.8)		1 ± 0.4 (0.2~2.3)
		42	103	15		112
Tip rotation	8 (3.3)			0.2 (0.2)	0.8 ± 0.3 (0.4~1.4)	0.9 ± 0.3 (0.4~1.4)
				2	7	8
Whole nose augmentation	122 (50.4)	0.3 ± 0.2 (0.1~0.8)	0.9 ± 0.4 (0.1~2.0)	0.4 ± 0.3 (0.1~1)	0.6 ± 0.3 (0.1~2.2)	1.6 ± 0.5 (0.5~3.0)
		44	91	18	73	122
Total	242 (100)	0.3 ± 0.2 (0.1~0.8)	0.8 ± 0.4 (0.1~2.0)	0.4 ± 0.2 (0.1~1)	0.7 ± 0.3 (0.1~2.2)	
		86	194	35	80	242

Data presented as mean ± SD (ranges)/number of recorded data.
In some instances, the relevant volume (mL) data per subsite were unavailable, and therefore the sum of the individual injected volume does not equal the total average volume.

dorsum augmentation group and the whole nose augmentation group (234 among 242). The NLA was measured for patients in either the tip rotation group or the whole nose augmentation group (130 among 242). For patients who received filler treatment for nasal hump correction, their RA (25 among 242) was additionally checked.

Based on the findings, the NFrtA increased on an average by 5.7 ± 4.1° from 138.7 ± 6.1° to 144.4 ± 4.9°, the MoNFcA decreased on an average by 1.9 ± 2.9° from 30.2 ± 4.6° to 28.3 ± 4.1°, whereas the radix height increased on an average by 78.3% postinjection. Meanwhile, the NLA showed a 9.4 ± 4.5° increase from 87.4 ± 10° to 96.8 ± 10°. In hump correction, the RA showed a decrease of 7.6 ± 2.6° from 10.9 ± 2.7° to 3.3 ± 2.9°. The overall changes were statistically significant (Figures 2–5, Table 3).

Complications

There were several mild transient adverse effects such as bruising, headache, swelling, and erythema. Although the authors were unable to establish the exact number of all adverse events due to certain inconclusive medical records, 3 cases involving vascular complication were documented in full detail.

The first case involved a 29-year-old female patient who had received interdomal suture several years ago. Immediately on filler injection, the nasal tip turned gray and violaceous, which the authors promptly treated by injecting hyaluronidase into the lesion and administering sublingual nitroglycerin for full recovery. The authors presume that such complications arose from the vascular compromise at the nasal tip resulting from vessel compression caused by the injected fillers. The other 2 cases were the result of intravascular filler injection which subsequently produced multiple erythematous mottled patches at the nasal dorsum, glabella, and forehead 1~3 days after the injection without presenting any ischemic signs during the procedure. These symptoms nonetheless fully disappeared within 1~2 months with appropriate treatment (Figure 6).

Not coincidentally, in all the 3 cases involving vascular compromise, fillers were injected with a needle instead

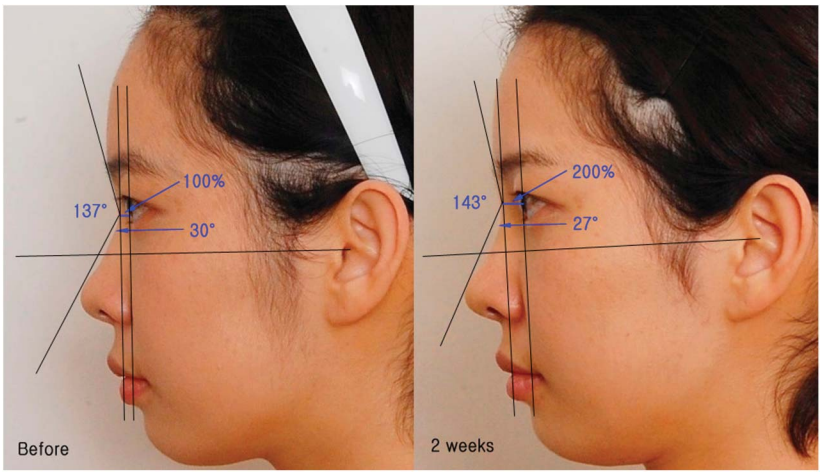

Figure 2. Nasal dorsum augmentation. 0.8 mL of hyaluronic acid filler injected at the nasal dorsum.

of a cannula. The PHA was used in the former compression case, whereas the GHA was used in the 2 latter cases. In all the 3 cases, the patients recovered without any severe sequelae on a combination treatment consisting of hyaluronidase injection and prescription of nitroglycerin, tadalafil tablets, steroids, and antibiotics.

Discussion

Filler rhinoplasty offers a compelling alternative to surgical augmentation rhinoplasty in terms of the absence of social downtime or surgical complications such as contracture or the thinning of the nasal tip. In particular, it provides a viable interim solution for patients who wish to obtain surgical rhinoplasty eventually but are too afraid to undergo an operation from the start because filler rhinoplasty can simulate the expected surgical results. Furthermore, with HA fillers, results are readily correctable simply by injecting hyaluronidase unlike surgical rhinoplasty or other fillers which are not easily reversible. Likewise, there are almost no limitations for retreatment with HA fillers. For these reasons, the authors rely entirely on HA fillers for filler rhinoplasty.

Filler rhinoplasty can be broadly divided into 3 types based on indication, namely, dorsum augmentation, tip rotation, and nasal tip augmentation. Dorsum augmentation is indicated for patients with a nasal hump, flat and short nose, saddle nose, irregularity, and other issues relating to the nasal dorsum. Here, the filler is injected along the nasal dorsum from the radix to the nasal tip to increase

Figure 3. Nasal dorsum augmentation for hump correction. 0.6 mL of hyaluronic acid filler injected at the nasal dorsum.

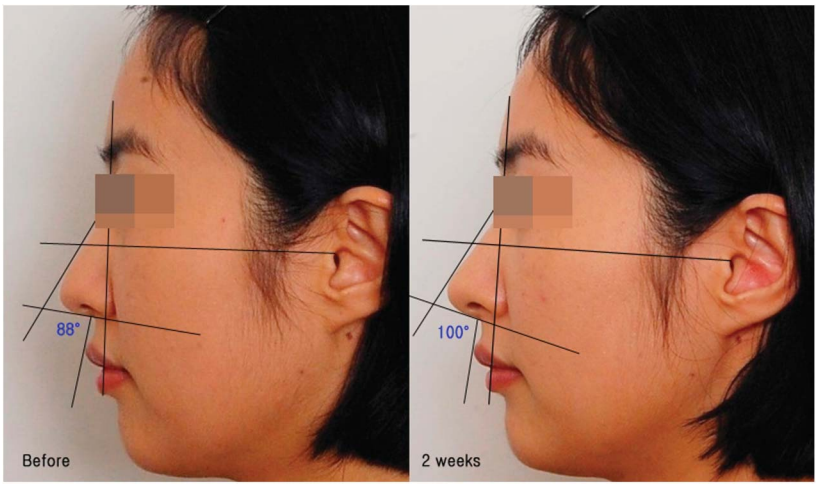

Figure 4. Nasal tip rotation. 0.9 mL of hyaluronic acid filler injected at the columella and the columella-nasolabial junction.

both the nasal length and height. Additional filler injection from the radix to the glabella area may also be necessary during dorsum augmentation to create a smooth arch-shaped transition from the medial eyebrow to the dorsum, particularly in patients with a deep glabella frown line.[2] This gives a more appealing and natural appearance to the nasal dorsum. These effects are equivalent to the surgical implant of nasal dorsum.[9]

Meanwhile, tip rotation or correction of acute NLA is indicated for patients with a nasal hump, columellar recession, droopy nasal tip, and/or inadequate tip projection. During the tip rotation, the filler is injected mainly into the columella and around the anterior nasal spine at the nasolabial junction.[2] This increases the NLA and causes the cephalic rotation of the nasal tip allowing for a more sophisticated nasal contour on the profile view. This procedure is equivalent to a columellar strut insertion in surgical rhinoplasty.[9–11]

Nasal tip augmentation is suitable for patients with bifid or otherwise blunt tip, in which case small volumes of fillers are injected intradermally or subdermally at the midline of the nasal tip. This helps reshape the contour of the nasal tip, allows a mild cephalic tip rotation, and gives sharpness to the tip.

For whole nose augmentation and hump correction, a combination of nasal dorsum augmentation, tip

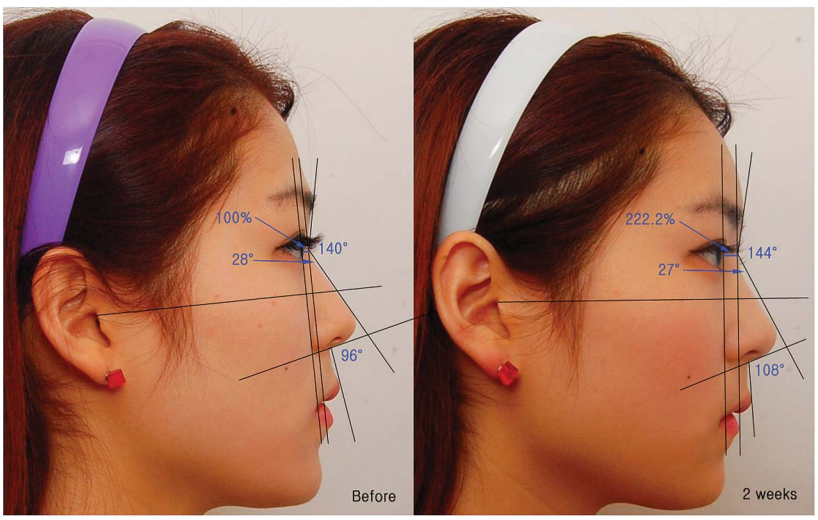

Figure 5. Whole nose augmentation. 1 mL of hyaluronic acid filler injected at the nasal dorsum with 0.6 mL of hyaluronic acid filler at the columella-nasolabial junction. Forehead filler augmentation was undertaken concurrently.

TABLE 3. Comparison of Anthropometric Factors Prefiller and Postfiller Rhinoplasty

Subgroup	*Anthropometric Factors (°)*	*Preinjection*	*Postinjection*	*Difference*
Nasal dorsum augmentation	NFrtA	138.0 ± 6.2	144.7 ± 4.5	6.7 ± 4.3*
	MoNFcA	30.8 ± 4.9	28.3 ± 4.1	−2.5 ± 2.8*
	RHI	100%	186%	86%
Tip rotation	NLA	80.0 ± 12.3	91.3 ± 9.3	11.3 ± 5.1*
Whole nose augmentation	NFrtA	139 ± 6.1	144.2 ± 5.1	5.2 ± 3.7*
	MoNFcA	29.7 ± 4.3	28.1 ± 4.0	−1.6 ± 2.8*
	NLA	87.6 ± 9.6	96.9 ± 10	9.3 ± 4.5*
	RHI	100%	176.2%	76.2%
Hump correction	RA†	10.9 ± 2.7	3.3 ± 2.9	−7.6 ± 2.6*
Total	NFrtA‡	138.7 ± 6.1	144.4 ± 4.9	5.7 ± 4.1*
	MoNFcA‡	30.2 ± 4.6	28.3 ± 4.1	−1.9 ± 2.9*
	NLA§	87.4 ± 10	96.8 ± 10	9.4 ± 4.5*
	RHI‡	100%	178.3%	78.3%

p value between preinjection and postinjection, paired *t*-test.

*$p < .01$.

†Measured only in the hump correction group (25 among 242).

‡Measured only among the nasal dorsum augmentation group and the whole nose augmentation group (234 among 242).

§Measured only in the tip rotation group and the whole nose augmentation group (130 among 242).

rotation, and nasal tip augmentation is applied simultaneously. Although nasal humps can often be corrected simply by augmenting the radix, at times this may have the undesirable effect of disproportionately elongating the nasal length. In such case, a concurrent cephalic tip rotation is recommended to balance out the nasal proportions.

In this study, a large number (96.7%) of patients underwent nasal dorsum augmentation either as part of the nasal dorsum augmentation group (112 patients or 46.3%) or as part of the whole nose augmentation group (122 patients or 50.4%). This underlines the fact that nasal dorsum augmentation is the most popular indication in filler rhinoplasty among the Asians. Equally significant, however, is the fact that more than half of the patients also underwent tip rotation. In fact, 8 patients chose to undergo tip rotation only, including 1 patient with a nasal hump and 7 patients with an underprojected tip for fear that

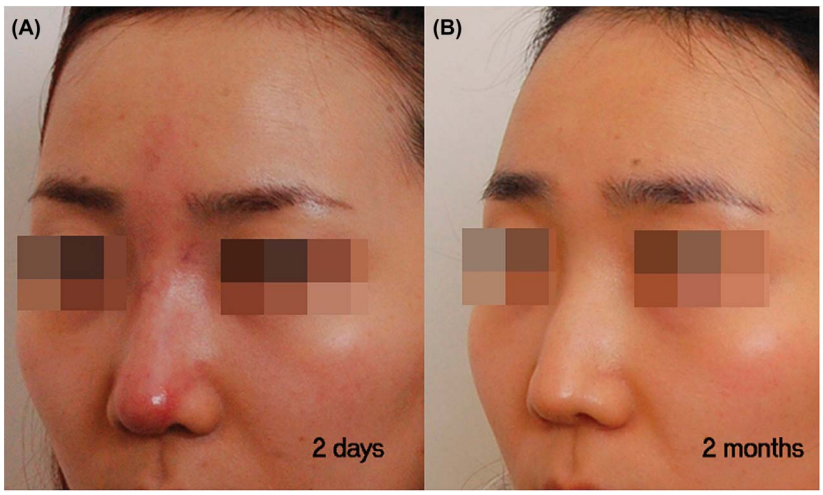

Figure 6. Complication case—intravascular injection. (A) Multiple erythematous mottled patches on the nasal tip and the central forehead (2 days after filler rhinoplasty). (B) No remaining symptoms or scars (2 months after filler rhinoplasty).

their nose might look overly elongated after any dorsum augmentation.

The adequate volume of fillers for filler rhinoplasty varies depending on the indication and the extent of correction required. Kim and colleagues reported 3 cases where 0.8∼1.1 mL of calcium hydroxyapatite was injected in the nasal dorsum and 0.7∼0.8 mL for tip rotation.[3] Schuster reported the use of 0.7∼0.9 mL for nasal dorsum and 1.3∼1.7 mL for whole nose augmentation.[12] In this study, the injected volume was 1 ± 0.4 mL for nasal dorsum augmentation, 0.9 ± 0.3 mL for tip rotation, and 1.6 ± 0.5 mL for whole nose augmentation. Because of the scarcity of previous literature on this point, however, a direct comparison between volumes injected in the different studies is hard to make. That withstanding, the volume of fillers used for nasal dorsum augmentation in this study is larger than others. This is due to the additional placement of fillers in the medial eyebrow-to-radix region to create the curvilinear arch, which alone amounts to 0.3 ± 0.2 mL of HA (Table 1).

Before anthropometric measurements, it is important to establish the proper definition of the relevant nasal landmarks on the profile view. Although the term "nasion" is often used misleadingly to refer to the nasal root (radix), it in fact represents the midpoint of the nasofrontal suture line.[2,13] When referring to the deepest point of the nasal bones, the proper term is the "sellion (subnasion)," which can be used interchangeably with the nasal root (radix).[13,14] For avoidance of confusion, the authors use the term "radix" in this article. Meanwhile, the rhinion marks the osteocartilaginous junction.[2]

An ideal nose is generally characterized as one with a high dorsum and projected tip despite specific variations according to ethnic preferences. The Korean preference is for a nose with an NFrtA of 135°∼140°, an NFcA of 30°∼35°, and an NLA of 95°∼100° with a moderate sex difference.[15] Compared with the Caucasian data where the ideal NFrtA is 115∼130°, NFcA 30∼40°, and NLA 90∼95° for men and 95∼110° for women, Asians seemingly prefer a larger NFrtA and a smaller NFcA and NLA.[16]

According to Oh and colleagues' study of 85 Korean patients on the anthropometric change after surgical rhinoplasty, the NFrtA increased only by 0.625° from 139.7° to 140.3°, whereas the NFcA decreased by 1.35° from 29.9° to 28.5°, and the NLA increased by 5.575° from 86.4° to 91.5°.[17] In the Brazilian study on the surgical rhinoplasty of 37 patients, the NFrtA increased by 8.5 ± 5.6° from 137.2 ± 6.6° to 145.8 ± 7.6°, the NFcA decreased by 2.3 ± 5.2° from 37.8 ± 5.4° to 35.4 ± 4.4°, and the NLA increased by 8.6 ± 9° from 99 ± 9.7° to 107.6 ± 7.5°.[18] During nasal dorsum augmentation, the change at the radix is greater than that at the nasal tip because the skin and subcutaneous tissue is looser at the radix than at the nasal tip. This has the effect of steepening the nasal dorsum line, resulting in an increase in the NFrtA and the decrease in the NFcA.

In this study, the NFrtA increased by 5.7 ± 4.1° from 138.7 ± 6.1° to 144.4 ± 4.9° far exceeding the 0.625° reported in Oh and colleagues' surgical data of Korean patients. The authors hypothesize that the additional fillers placed in the radix-to-glabella region contributed more to increasing the NFrtA than the surgical rhinoplasty in Koreans. The MoNFcA in this study shared a pattern similar to the surgical rhinoplasty case, decreasing by 1.9 ± 2.9° from 30.2 ± 4.6° to 28.3 ± 4.1°.

As noted previously, another anthropometric value measured for assessing the efficacy of dorsum augmentation was the RHI. The RHI showed a marked increase of 78.3% on an average from the baseline. This indicates that the RHI gives much clearer insight into the anthropometric changes from dorsum augmentation than the NFrtA or the NFcA.

Meanwhile, the NLA in this study showed an increase of 9.4 ± 4.5° from 87.4 ± 10° to 96.8 ± 10°, which again represents an improvement over Oh's surgical data in Koreans while also corresponding to the range of the NLA most favored by the Koreans. This suggests that filler rhinoplasty serves as a viable alternative to a columellar strut insertion in achieving cephalic tip rotation.

Nasal hump is a popular indication of both filler rhinoplasty and surgical rhinoplasty, and yet surprisingly no objective anthropometric factors have been

established for assessing either the severity or the efficacy of the correction. As such, the authors developed the concept of "RA." Based on the findings of this study, the RA decreased by 7.6 ± 2.6° from 10.9 ± 2.7° to 3.3 ± 2.9° in the hump correction group. The authors therefore propose the RA as a useful tool for assessing the severity of nasal humps and the efficacy of the correction (Table 2).

The most serious adverse event that could possibly occur during filler rhinoplasty is vascular complication. Fortunately, only 1.2% of the patients in this study developed any vascular complications. All managed to recover without any severe sequelae such as skin necrosis or blindness. The causes of vascular complication are largely twofold, that is, vascular compression and/or intravascular embolization by the injected filler material. As was well demonstrated in the authors first example where the patient developed ischemic signs immediately after filler injection into the nasal tip, vascular compression caused by fillers injected into limited space can cause vascular complications in patients whose vascular circulation has already been compromised by a previous nose surgery. Therefore, keen attention should be paid to patients with a history of nose surgery, a procedure popular among the Asians.

Just as importantly, every effort should be made to avoid any intravascular injection of fillers which at its worst can bring about skin necrosis and even blindness. Blood supply to the nasal dorsum is mainly provided by the dorsal nasal artery, a branch of the ophthalmic artery.[2] Therefore, fillers injected inadvertently into the dorsal nasal artery may migrate in the reverse direction to the ophthalmic artery causing occlusion to the branches of the ophthalmic artery such as the retinal artery and the posterior ciliary artery, which in turn may lead to blindness.[19] Meanwhile, the lower parts of the nose including the nasal tip, the alar, and the columella receive blood supply from the branches of the facial artery such as the lateral nasal artery, the columellar branch of the superior labial artery, and the inferior alar branch. These branches form broad-based anastomosis among themselves and with the dorsal nasal artery at the nasal dorsum. Therefore, any inadvertent intravascular injection of fillers at the columella or the nasal tip may also travel into the dorsal nasal artery contributing to blindness as well.[19] According to the report by the Korean Retina Society in 2014, the nose was the third most common site for filler-induced blindness representing 23% of cases after the glabella (59%) and the nasolabial folds (25%).[20]

Therefore, it is essential for practitioners to be thoroughly aware of the facial anatomy and to strictly adhere to the relevant preventative strategies. As a key prevention strategy against intravascular injection, the authors recommend the routine use of the cannula instead of a needle to avoid the inadvertent intravascular injection of fillers. Not coincidentally, a needle was used in both intravascular injections encountered at the authors' clinic. Where needles are used inevitably, blood aspiration tests should be performed before injection to ensure the needle is not accidentally placed in the vessel. However, because of the thin vessels of the nose, blood aspiration test may present false-negative results on intravascular puncture. Despite the routine preinjection aspiration test performed in this case, vascular complication nonetheless occurred on injection of GHA with a 30-gauge needle. Considering that blood aspiration test may produce false negatives depending on the filler type, needle gauge, and vessel size, it is important to select the right needle of adequately large gauge for blood aspiration.[21] Furthermore, PHA is preferable to GHA for filler rhinoplasty because of the relative ease with which aspiration tests were performed. As a general rule, slower injection speed, smooth progression of the cannula, the use of cannulas of at least 23 gauge or larger, and retrograde injection technique can help reduce the risk of vascular complications.[19] Practitioners should also pay close attention to any ischemic signs such as pain after filler injection, blanching during or immediately after the injection, and any subsequent violaceous or grayish discoloration, in which case timely and adequate intervention is required. The first-line treatment for vascular complications in the case of HA fillers is the subcutaneous injection of hyaluronidase into the ischemic lesion and adjacent areas as soon as possible within one day.[22] For this reason, HA fillers should be considered the preferred filler type for treating areas particularly vulnerable to intravascular injection such

Box 1. Prevention and Management Strategies for Vascular Complication of Filler Injection

Preventative Strategies	*Management Strategies*
1. Thorough knowledge of the facial anatomy, especially facial vessels	1. Hyaluronidase injection into the lesion and the adjacent area for HA fillers
2. Routine use of HA filler	2. Application of topical nitroglycerin
3. Routine use of cannulas 23 gauge or larger	3. Sublingual nitroglycerin
4. Routine aspiration before injection when needle is used	4. PO sildenafil or tadalafil
5. Retrograde injection technique	5. PO aspirin (100 mg)
6. Slower injection speed with lower pressure	6. PO steroid
7. Smooth progression of the cannula	7. PO antibiotics
8. Extra precaution when treating patients with a previous record of surgical procedure in the area	8. Warm massage 9. Hyperbaric oxygen treatment if available

as the nose, glabella, nasolabial fold, and forehead. Intake of sublingual nitroglycerin, per oral (PO) aspirin (100 mg), and sildenafil or tadalafil facilitating peripheral blood circulation is also a prerequisite.[23] Steroids and antibiotics also help reduce the risk of inflammation and any possible secondary infection.[12] Subject to availability, hyperbaric oxygen treatment is also recommended as a well-known treatment modality for various peripheral ischemic diseases. The relevant prevention and management strategies for filler-induced vascular complications are summarized in Box 1.

Conclusion

Based on the anthropometric analyses, the authors have established that filler rhinoplasty is a simple yet effective treatment modality producing outcomes comparable with surgical augmentation rhinoplasty albeit relatively short lived. The authors also demonstrated that dorsum augmentation was the most popular indication among filler rhinoplasty. Of the various applicable anthropometric factors, the authors proposed the RHI as being more helpful than the NFrtA and the NFcA for evaluating the effectiveness of dorsum augmentation, whereas the NLA was the best for assessing nasal tip rotation. Meanwhile, the authors introduced the RA as a new and viable anthropometric factor for evaluating the severity of nasal humps and the efficacy of the correction. To the authors' knowledge, this is the first study to confirm the efficacy of the filler rhinoplasty using objective anthropometric measurements. The authors hope their findings will serve as an objective reference point for future studies regarding the effectiveness of filler rhinoplasty.

References

1. Andretto Amodeo C. The central role of the nose in the face and the psyche: review of the nose and the psyche. Aesthet Plast Surg 2007;31:406–10.
2. Seo KK. Chap. 17 nose. In: Carrhthers J, Carruthers A, editors. *Soft Tissue Augmentation*. Philadelphia, PA: Elsevier; 2012; pp. 112–22.
3. Kim P, Ahn JT. Structured nonsurgical Asian rhinoplasty. Aesthet Plast Surg 2012;36:698–703.
4. Leong SC, White PS. A comparison of aesthetic proportions between the oriental and Caucasian nose. Clin Otolaryngol 2004;29:672–6.
5. Biller JA, Kim DW. A contemporary assessment of facial aesthetic preferences. Arch Facial Plast Surg 2009;11:91–7.
6. Prendergast PM. Chap. 2 facial proportions. In: Erian A, Shiffman MA, editors. *Advanced Surgical Facial Rejuvenation*. Philadelphia, PA: Elsevier; 2012; pp. 112–122.
7. Park JH, Mangoba DC, Mun SJ, Kim DW, et al. Lengthening the short nose in Asians: key maneuvers and surgical results. JAMA Facial Plast Surg 2013;15:439–47.
8. Ahmed O, Dhinsa A, Popenko N, Osann K, et al. Population-based assessment of currently proposed ideals of nasal tip projection and rotation in young women. JAMA Facial Plast Surg 2014;16:310–8.
9. Jin HR, Won TB. Recent advances in Asian rhinoplasty. Auris Nasus Larynx 2011;38:157–64.
10. Atighechi S, Sajadinejad BS, Baradaranfar MH, Dadgarnia MH, et al. Caudal extension graft versus columellar strut with plumping graft for acute nasolabial angle correction in rhinoplasty surgery. Eur Arch Otorhinolaryngol 2015;272:1673–7.
11. Rohrich RJ, Kurkjian TJ, Hoxworth RE, Stephan PJ, et al. The effect of the columellar strut graft on nasal tip position in primary rhinoplasty. Plast Reconstr Surg 2012;130:926–32.
12. Schuster B. Injection rhinoplasty with hyaluronic acid and calcium hydroxyapatite: a retrospective survey investigating outcome and complication rates. Facial Plast Surg 2015;31:301–7.
13. Swennen GRJ. Chapter 5. 3–D Cephalometric soft tissue landmarks. In: Swennen GRJ, Schutyser F, Hausamen JE, editors. *Three-dimensional Cephalometry: A Color Atlas and Manual*. Heidelberg, Germany: Springer-Verlag; 2006; pp. 187–190.

14. Lazovic GD, Daniel RK, Janosevic LB, Kosanovic RM, et al. Rhinoplasty: the nasal bones—anatomy and analysis. Aesthet Surg J 2015;35:255–63.

15. Han KH, Kim SJ, Kang JS. A somatometric study of the Korean nose. J Korean Soc Plast Reconstr Surg 1982;9:1.

16. Powell N, Humphreys B. *Proportions of the Aesthetic Face*. New York, NY: Thieme-Stratton; 1984.

17. Oh HS, Kang SY, Kim KY, Yang WY. Anthropometric analysis on facial profile alterations following augmentation rhinoplasty with nasal tip plasty. J Korean Soc Aesthet Plast Surg 2010;16:144–50.

18. Pasinato R, Mocellin M, Arantes MC, Coelho MS, et al. Pre and post operative facial angles in patients submitted to rhinoplasty. Int Arch Otorhinolaryngol 2008;12:393–6.

19. Beleznay K, Carruthers JD, Humphrey S, Jones D. Avoiding and treating blindness from fillers: a review of the world literature. Dermatol Surg 2015;41:1097–117.

20. Park KH, Kim YK, Woo SJ, Kang SW, et al. Iatrogenic occlusion of the ophthalmic artery after cosmetic facial filler injections: a national survey by the Korean Retina Society. JAMA Ophthalmol 2014;132: 714–23.

21. Casabona G. Blood aspiration test for cosmetic fillers to prevent accidental intravascular injection in the face. Dermatol Surg 2015;41:841–7.

22. DeLorenzi C. Transarterial degradation of hyaluronic acid filler by hyaluronidase. Dermatol Surg 2014;40:832–41.

23. DeLorenzi C. Complications of injectable fillers, part 2: vascular complications. Aesthet Surg J 2014;34:584–600.

Address correspondence and reprint requests to: Kyle K. Seo, MD, PhD, Modelo Dermatology Clinic, Jin Building, 5F, 118-15, Cheongdam-dong, Gangnam-gu, Seoul, Korea 135-955, or e-mail: doctorseo@hotmail.com