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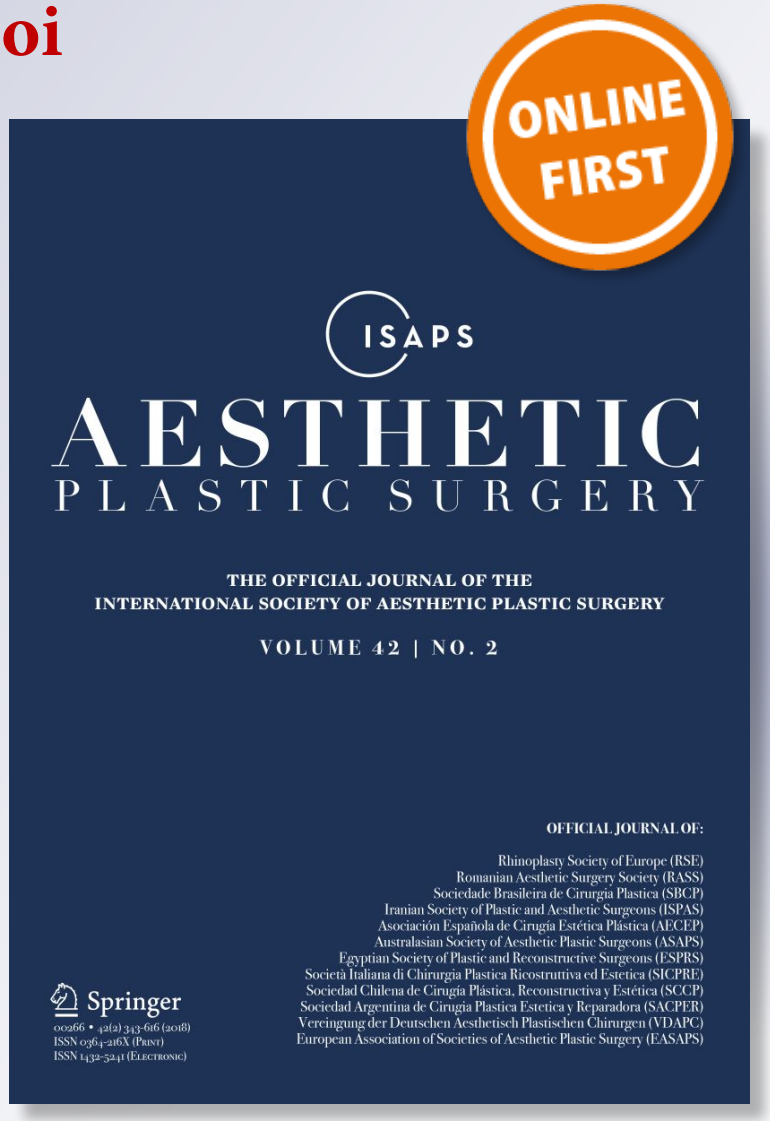
Aesthetic Plastic Surgery

ISSN 0364-216X

Aesth Plast Surg
DOI 10.1007/s00266-018-1279-7



Springer

Aesth Plast Surg
https://doi.org/10.1007/s00266-018-1279-7

A Safer Non-surgical Filler Augmentation Rhinoplasty Based on the Anatomy of the Nose

Gyu Sik Jung[1] · Seung Gyun Chu[1] · Jeong Woo Lee[1] · Ho Yun Chung[1] · Jung Dug Yang[1] · Byung Chae Cho[1] · Ji Won Oh[2,3] · Kang Young Choi[1]

Received: 29 July 2018 / Accepted: 18 November 2018

Abstract

Background Filler augmentation rhinoplasty is a quick, non-surgical procedure that can produce outcomes comparable to open rhinoplasty surgery. However, the increased frequency of vascular complications has emerged as an important issue. The present study aimed to investigate measures to overcome the vascular complications based on the anatomy of the nose.

Methods A colored filler was injected into cadavers for augmentation of the nasal dorsum using the retrograde injection technique and direct percutaneous injection technique. The concavity of the sellion area was measured using lateral view cephalography X-ray images. Lastly, we used ultrasonography to determine filler location in 20 Korean patients who had filler injected into the sellion area by injection at the infratip lobule.

Results Filler was injected into the superficial layer by the retrograde injection technique in three cadavers and into the deep layer by direct percutaneous injection technique in another three cadavers. The average angle between the nasal dorsum skin and sellion was found to be 10.2 ± 2.8 degrees, while the minimum angle was 5.1 degrees. The average distance between the needle tip and nasal bone was 1.9 ± 0.3 mm, while the minimum distance was 0.4 mm.

Conclusions When performing filler augmentation rhinoplasty on the sellion area, direct percutaneous injection from the glabella can allow more accurate injection into the supraperiosteal level, which can reduce complications such as visual loss and skin necrosis due to vascular compromise.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Rhinoplasty · Nose · Filler

Introduction

After the United States Food and Drug Administration's approval of a hyaluronic acid-based injectable filler in 2003, which has no side effects when injected into the body, there was a full-scale growth of the filler market. Augmentation rhinoplasty using fillers has reached the stage where it has overcome the limitations of it being a non-surgical procedure and can produce results that are comparable to those produced by open rhinoplasty surgery. However, with the increasing use of injectable fillers, the associated vascular complications, such as skin necrosis and visual loss, and other limitations have become a frequent cause of concern. This has led to research into a new procedure that can produce a more effective result with regard to the intended outcome in the nasal region, with the intended shape.

The injectable method of correction of an under-projected dorsum using commonly used fillers involves inserting a needle or cannula into the infratip lobule to

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Published online: 17 December 2018

augment the nasal dorsum from the sellion area using the retrograding threading injection technique. However, because the nasal bone is concave, this method can be a major cause of vascular complications. In this report, we discuss measures, which are based on the anatomy of the nasal bone, to overcome the vascular complications of filler augmentation rhinoplasty.

Materials and Methods

Cadaver Study

We used six cadavers aged 47–73 years [mean 62.2 ± 10.1 (SD); 4 men, 2 women]. Augmentation rhinoplasty was performed by injecting colored filler into the cadaver with a 23-gauge, 60-mm long needle (Korea Vaccine Co, Seoul, Republic of Korea). The colored filler was prepared by mixing 0.2 cc of pink color stock solution (Montmartart, Seoul, Republic of Korea) and 1 cc of filler (amalian 20 medium; S&V Technologies, Hennigsdorf, Germany). In three cadavers, a long needle was inserted into the infratip lobule to augment the nasal dorsum from the sellion area by the retrograde threading technique (Fig. 1). In the remaining three cadavers, direct percutaneous injection from the glabella was performed. To inject the filler as deeply as possible, the needle was inserted bevel-down once it touched the bone. Subsequently, we confirmed the location of the layer of filler injection by performing a dissection (Fig. 2).

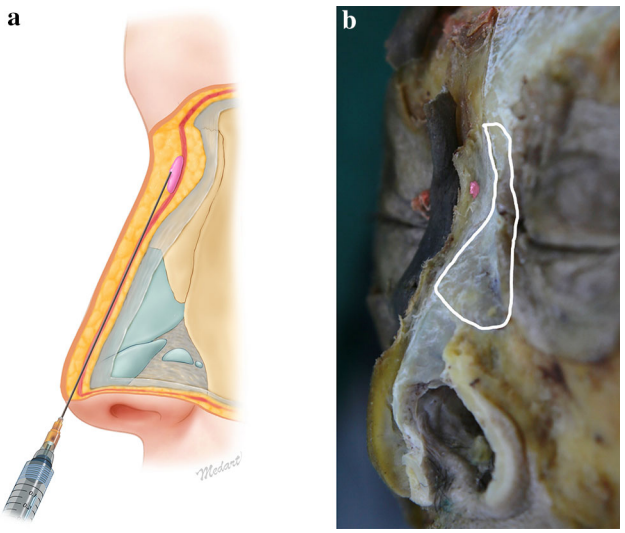

Fig. 1 A long needle was inserted through the infratip lobule to augment the sellion area by the retrograde threading technique. Filler (pink) was injected into the superficial layer. **a** Schematic drawing. **b** Cadaver study (white line nasal bone)

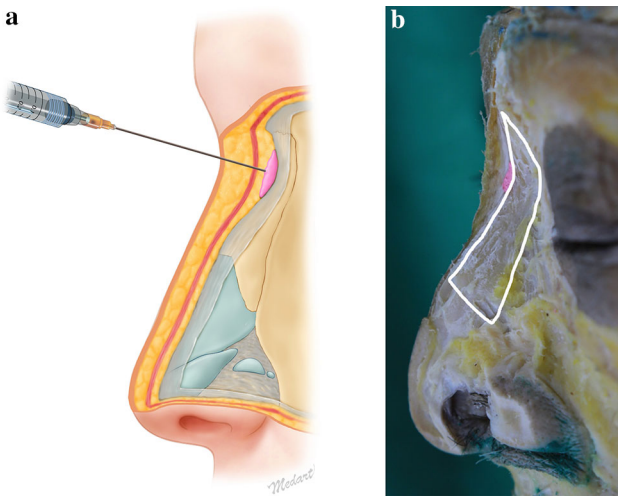

Fig. 2 Direct percutaneous injection from the glabella was performed. Filler (pink) was injected into the deep layer. **a** Schematic drawing. **b** Cadaver study (white line nasal bone)

Cephalography Study

To assess the concavity of the sellion area, we measured the angle between the skin of the nasal dorsum and the nasal bone of the sellion area using lateral cephalometric radiographs (CX-90 SP; Asahiroentgen Co, Kyoto, Japan) (Fig. 3). The images of patients who underwent maxillary and mandibular surgery and those with incompatible occlusion were excluded. The angle was measured by examining the lateral cephalograms obtained at the Department of Dentistry of Kyungpook National University Hospital between January 2013 and December 2017. Angle measurements were taken in 92 patients aged

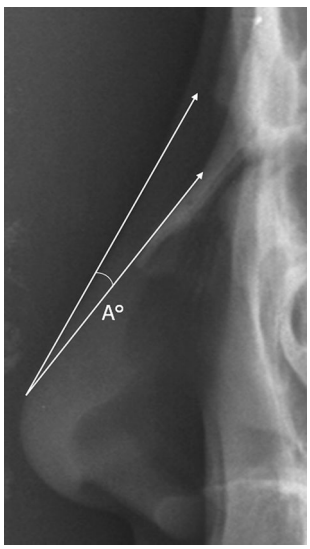

Fig. 3 To assess the concavity of the sellion area, we measured the angle A° between the skin of the nasal dorsum and the nasal bone of the sellion area by lateral cephalography

19–69 years (mean 42.2 ± 20.4; 40 men, 42 women). Statistical analysis was performed using the Kolmogorov–Smirnov test for normality. All analyses were performed using SPSS software (IBM Corp., Armonk, NY).

Ultrasonography Study

To augment the nasal dorsum from the sellion area by the retrograde threading technique, we inserted a 25-gauge and 70-mm blunt cannula (Nanum Company, Seoul, Republic of Korea) into the infratip lobule of 20 Korean patients aged 20–60 years (mean 41.3 ± 14.4; 5 men, 15 women) (Fig. 4). The distance between the nasal bone and the cannula tip was measured using ultrasonography (M2540A Envisor; Philips Ultrasound, Andover, MA) in 20 patients that consented to measurement. Sedation was not performed. A nerve block was applied to the infratrochlear nerve and internal nasal branch of the infraorbital nerve using 1% lidocaine with 1:200,000 epinephrine, and the procedure was initiated 10 min later [1]. A cannula tip was inserted parallel to the nasal dorsum, and the distance was measured at the nearest possible point to the nasal bone. The Kolmogorov–Smirnov test for normality test was used to analyze the results. All analyses were performed using SPSS software (IBM Corp, Armonk, NY).

All procedures were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments.

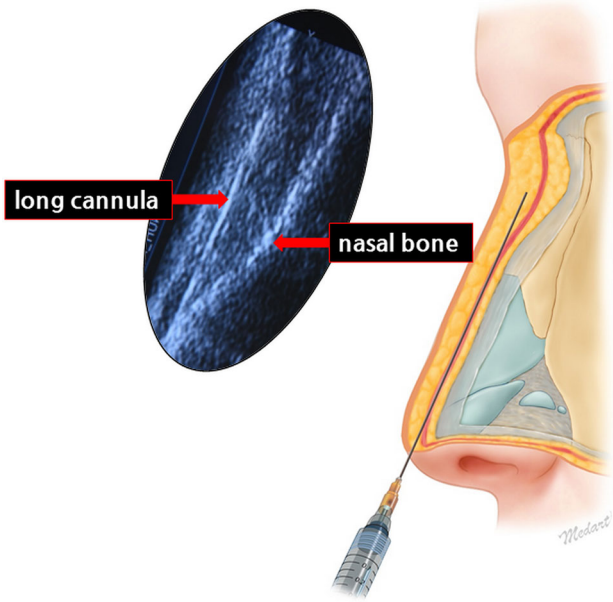

Fig. 4 The distance between the nasal bone and the needle tip was measured by the retrograde threading technique

Results

Cadaver Study

In the three cadavers in whom nasal dorsum augmentation was performed by inserting a long needle into the infratip lobule using the retrograde threading technique, we initially confirmed filler injections in the superficial fatty and fibromuscular layers. In the other three cadavers, the filler was injected by direct percutaneous injection from the glabella. The filler was located in the deep fatty layer or the supraperiosteal layer, which is considered an avascular layer.

Cephalography Study

Based on the lateral cephalograms, the angle between the skin of the nasal dorsum and the nasal bone was on average 10.2 ± 2.8 degrees. The minimum angle was 5.1 degrees. The Kolmogorov–Smirnov test showed a normal distribution.

Ultrasonography Study

Filler was injected into the superficial layer. The average distance between the cannula tip and nasal bone was 1.9 ± 0.3 mm, whereas the minimum distance was 0.4 mm. Therefore, precise injection into the periosteal layer was difficult with infratip lobule injection via the linear threading technique. This was the anatomical result of the angle between the nasal dorsum skin and the sellion. The Kolmogorov–Smirnov test showed a normal distribution.

Case Study

Augmentation rhinoplasty was performed in the sellion area by direct percutaneous injection from the glabella using a 25-gauge and 70-mm blunt cannula (Nanum Company). The filler was injected into the area encompassing the sellion and the nasal tip using the retrograde threading technique.

Case 1

Filler injection was performed in the nose of a 22-year-old female patient by injecting filler (amalian 20 medium, amalian 24 SF advanced; S&V Technologies, Hennigsdorf, Germany). The overall nasal area was properly raised in both front and side views (Fig. 5).

Fig. 5 A 22-year-old female patient was injected with filler (amalian 20 medium, amalian 24 SF advanced; S&V Technologies, Hennigsdorf, Germany). **a** Preoperative photograph of front view. **b** Immediate postoperative photograph of front view. **c** Preoperative photograph of side view. **d** Immediate postoperative photograph of side view. The overall nasal area was raised in both front and side views

Case 2

Injection of filler (amalian 20 medium, amalian 24 SF advanced; S&V Technologies, Hennigsdorf, Germany) was carried out in a 32-year-old female patient. The procedure was performed in the radix and dorsum and resulted in a well-elevated sharp nasal tip without excessive bulkiness (Fig. 6).

Discussion

Being centrally located on the face, the nose has a significant influence on the balance of the adjacent facial features such as the eyes and the mouth and plays an important role aesthetically [2]. Due to the fact that filler injected into the nose gradually disappears over a certain period of time, the procedure needs to be repeated. However, the relative lack of bruising or swelling compared with surgery means that the patient can carry on his or her daily life without any discomfort or inconvenience. In addition, the lack of

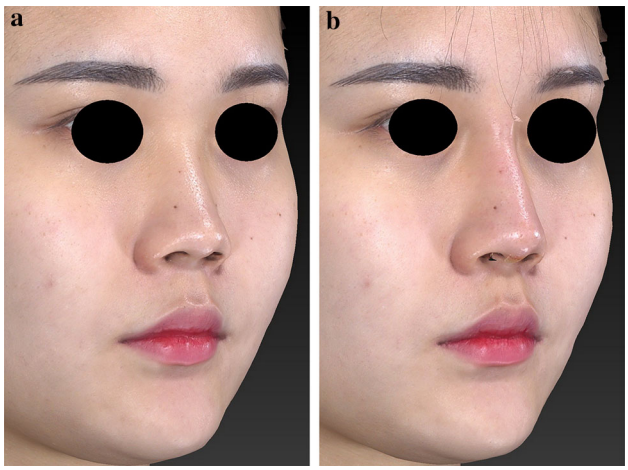

Fig. 6 A 32-year-old patient was injected with filler (amalian 20 medium, amalian 24 SF advanced; S&V Technologies, Hennigsdorf, Germany). The procedure was performed in the radix and dorsum and resulted in a well-elevated sharp nasal tip. **a** Preoperative photograph. **b** Immediate postoperative photograph

side effects, such as curving of the nose and thinning and/or sharpening of the nasal tip due to contracture, highlights the safety of this procedure. In Asia, where the demand for rhinoplasty is significantly higher than that in other regions of the world, most nasal augmentation procedures can be performed with fillers without a surgical intervention [3, 4].

A successful filler augmentation rhinoplasty can only be based on an accurate anatomical understanding of the nose. The nose is a three-dimensional facial structure that has considerable variations in external appearance and anatomical structure based on each individual and ethnic group. Further, a correct understanding of the anatomy of the nose and the characteristics of each filler is essential because filler augmentation is based on insertion of the needle into an invisible cavity under the skin to reshape the nose. This is crucial for preventing disastrous complications and achieving a good aesthetic result [4, 5].

For rhinoplasty surgery in Caucasians, the initial starting point of the implant should be at the double eyelid; however, Asian patients require an implant that starts at the eyelashes or the upper margin of the pupil for a more natural look [5]. It is generally accepted that the sellion in Asians is reshaped to be lower than the average sellion in Caucasians. Whereas it creates a more natural looking outcome to the use of the lower end of the double eyelid as the saddle point in women, it is more aesthetically desirable to set the saddle point slightly higher [6]. In the case of filler augmentation, the same standards should be used to set the starting point of the augmentation in the sellion.

In Asians, the sellion point is typically located deeper and lower in the nose than in Caucasians [7]. The ethnic characteristics of the midface can be determined by the appearance of the connection between the midface and the

upper face in the area of the sellion point. The silhouette line from the medial eyebrow to the nasal dorsum is also very important in the evaluation of facial aesthetics because, in basic facial proportions, the length of the nose is one-third the length of the face [8]. Thus, the sellion point is very important.

The soft tissue of the nose consists of: (1) skin, (2) a superficial fatty layer, (3) a fibromuscular layer, (4) a deep fatty layer, and (5) periosteum or perichondrium. It is known that the main arteries of the dorsum of the nose are located at the level of the superficial or deep fatty layers. In the lower part of the dorsum, the dorsal nasal arteries are adjacent to the fibromuscular and deep fatty layers; however, in the upper part of the dorsum, the dorsal nasal arteries are located at the superficial fatty layer, immediately above the fibromuscular layer [2, 9]. Therefore, the dorsal arteries are generally found at a deeper level than the fibromuscular layer [10]. However, they take a more superficial position going toward the radix. According to recent studies, a branch of the dorsal nasal arteries is located in the superficial part of the deep fatty layer, immediately below and parallel to the fibromuscular layer [11]. Therefore, the filler must be injected into a layer deeper than the fibromuscular layer to prevent injecting into the blood vessels [2].

Superficial filler injection increases the possibility of blood vessel compression of the thin vascular network in the superficial layer, which is surrounded by dense and tough tissue. However, filler injection into the deep layer minimizes this possibility since the blood vessels are thicker and stronger, while the surrounding tissue is relatively soft and flexible compared to the superficial layer. Therefore, while a superficial filler injection results in a more effective augmentation, it is safer to inject the filler into the deep layer [10]. It has been reported that the skin of the nose and the tissue underneath the skin are thicker in Asians in comparison with Caucasians. This suggests that while the unevenness and/or asymmetry observed post-augmentation can be concealed to a certain degree, the thicker tissue under the nasal skin in Asians requires more caution during filler augmentation [2].

Generally, the measures to minimize vascular complications include avoidance of large-bore needles; using blunt cannulas or small-bore needles; injecting epinephrine with the filler to reduce the size of the vessels; using smaller syringes; always withdrawing before injecting; injecting slowly, gently, and in small aliquots; never injecting in a previously traumatized area; knowing the anatomical plane and depth for each injection; and ceasing injection immediately if the subject complains of pain or vision issues. Blindness after the facial injection of particulate materials was first reported in 1963 [12]. The recent remarkable growth in the popularity of the cosmetic filler market has caused a dramatic increase in the number of cases of blindness. Blindness caused by filler injection is a disastrous complication for both the patient and the physician. While various interventions can be attempted in cases of blindness, recovery is very difficult [13]. Thus, ongoing and persistent research efforts are crucial to minimize the risk of filler injection-associated blindness.

If filler has to be injected into the side of the nasal dorsum, for example, for correction of a deviated nose, the needle should never move in parallel with the direction of the blood vessel. After inserting the needle into the midline, the needle tip should move to the side to prevent injection of the filler into the blood vessel, although there may be some bleeding due to vessel injury [14]. While the dorsal nasal artery is generally known to take a more lateral than central position, as the dorsal nasal artery originates from the ophthalmic artery on both sides, there are branches that intersect and connect at the midline. Specifically, it should be noted that in certain cases, a branch originating from the artery on the opposite side crosses the nasal dorsum and spreads out [10].

During the cadaver studies, we believed that the colored filler was injected into the supraperiosteal layer. However, the cadaver dissection revealed that the filler was in the superficial, deep fatty, or fibromuscular layers. Further cadaver studies are required to ensure precise filler injections into the target layer.

This study has some limitations. First, the cadaver (6 cadavers), cephalography (92 cases), and ultrasonography (20 cases) studies' sample sizes were all small. Second, as the study samples only included Koreans, ethnic differences were not considered. In particular, the nose may differ between Asians and Caucasians. Subsequent studies should investigate ethnic differences and include a larger study population.

Conclusions

The periosteum or perichondrium is known to lack both fibrous septae and blood vessels. The injection plane of the filler should be at the level of the supraperiosteal or supraperichondrial layers, which is the deepest level of the deep fatty layer. Thus, precise filler injection into the supraperiosteal or supraperichondrial layers, which are avascular, can significantly reduce the risk of vascular complications. When a filler is injected into the sellion area, it should be injected more directly than the infratip lobule approach, and the needle should be inserted bevel-down into the nasal tip.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

References

1. Iwanaga J, Watanabe K, Oskouian RJ, Tubbs RS (2018) Distribution of the internal nasal branch of the infraorbital nerve to the nasal septum: application to rhinoplasty. J Plast Reconstr Aesthet Surg 71:665–669
2. Jung GS, Kwon JH, Lee JW, Yang JD et al (2017) A new approach to nasomaxillary complex type of nasal bone fracture: clip operation. J Craniomaxillofac Surg 45:954–961
3. Kim HJ, Seo KK, Lee HK, Kim J (2015) Clinical anatomy of the face for filler and botulinum toxin injection, 1st edn. Springer, Daegu
4. Kurkjian TJ, Ahmad J, Rohrich RJ (2014) Soft-tissue fillers in rhinoplasty. Plast Reconstr Surg 133:121–126
5. Suh MK (2012) Asian rhinoplasty, 1st edn. Korea Academy of Plastic Surgery, Daegu
6. Jeong JY (2016) Rhinoplasty, 1st edn. Medic Medicine, Daegu
7. Chan EK, Soh J, Petocz P, Darendeliler MA (2008) Esthetic evaluation of Asian–Chinese profiles from a white perspective. Am J Orthod Dentofacial Orthop 133:532–538
8. Mizumoto Y, Deguchi T Sr, Fong KW (2009) Assessment of facial golden proportions among young Japanese women. Am J Orthod Dentofacial Orthop 136:168–174
9. Ozturk CN, Larson JD, Ozturk C, Zins JE (2013) The SMAS and fat compartments of the nose: an anatomical study. Aesthet Plast Surg 37:11–15
10. Koh IS (2014) Complication of filler, necrosis and blindness, 1st edn. Ilchokak, Daegu
11. Hong KW (2017) Filler, botulinum toxin, 1st edn. MD World Medical Book, Daegu
12. Von BAHR (1963) Multiple embolisms in the fundus of the eye after an injection in the scalp. Acta Ophthalmol 41:85–91
13. Rzany B, DeLorenzi C (2015) Understanding, avoiding, and managing severe filler complications. Plast Reconstr Surg 136:196–203
14. Moon HJ (2016) Use of fillers in rhinoplasty. Clin Plast Surg 43:307–317