Injection Rhinoplasty with Hyaluronic Acid and Calcium Hydroxyapatite: A Retrospective Survey Investigating Outcome and Complication Rates

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Abstract

Injection rhinoplasty offers an attractive, reversible alternative to surgery. Here we assessed outcome, longevity of benefits, adverse effects, and patient assessment of injection rhinoplasty, using degradable synthetic fillers. Forty-six patients who underwent injection rhinoplasty using degradable fillers over the past 3 years were assessed (calcium hydroxyapatite: 26 patients, hyaluronic acid: 20 patients). Comparison of pre- and postoperative images indicated realistically achievable treatment results. Patient satisfaction was assessed using a 5-point questionnaire at 3 weeks and 9 months posttreatment. Forty-six patients (88 areas) were treated. At 3 weeks posttreatment, 85% of patients were satisfied with treatment results. At 9 months or later posttreatment, 87% of patients were very/completely satisfied with treatment results, regardless of filler used. Treatment longevity varied between 6 and 30 months (mean: 13.5 months). Positive evaluation was mainly due to accurate prediction of achievable results to meet patient expectations. There were one moderate and two severe complications, all following calcium hydroxyapatite treatment. Two resolved completely following treatment and one patient was lost to follow-up. This resulted in subsequent exclusive use of hyaluronic acid filler. Injectable biodegradable fillers are effective for correction of minor nasal deformities or irregularities. Attention must be given to injection technique and adverse effect management.

Keywords

- calcium hydroxyapatite
- hyaluronic acid
- injection rhinoplasty

Injection rhinoplasty is a medical procedure in which injectable fillers are used to modify the nose without the need for invasive surgery. Commonly this comprises filling depressed areas, lifting the angle of the tip or smoothing the appearance of bumps on the nose bridge. Injection rhinoplasty offers an attractive alternative to surgical rhinoplasty as it is reversible if the results do not meet patient requirements. Furthermore, there is little downtime, with the most common adverse effects comprising bruising, swelling, and redness that usually resolve within 1 week. It is a much cheaper procedure than surgical rhinoplasty, although it is important to remember that repeat treatments may be needed every 1 to 2 years. In addition, it can provide a patient with a stepping stone before fully committing to permanent surgical rhinoplasty and it can also provide a solution for those who have undergone unsuccessful earlier surgical rhinoplasty procedures. However, there are some disadvantages as it is not a permanent solution, the administration of fillers means injection rhinoplasty can increase the size of the nose, and there are also limitations in terms of what can be achieved, with some patients having unrealistic expectations. Attitude to longevity plays an important part in the patient's decision to opt for injection rhinoplasty. In our practice, we exclusively use degradable synthetic fillers, and therefore many patients reject treatment for this reason. Thus, a carefully

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considered treatment plan with a clear outline of realistic results is crucial for patient satisfaction.

In this study, we aimed to assess the outcome, longevity of beneficial effects, adverse effects and patient assessment of injection rhinoplasty using degradable synthetic fillers.

Patients and Methods

All patients provided written informed consent for treatment. Because the study was a retrospective review of patient's treatment, no Ethics Committee approval was needed; however, the principles of the Declaration of Helsinki were followed. Informed consent was obtained from all patients for off-label treatment with hyaluronic acid (HA) or calcium hydroxyapatite (CaHA) for soft tissue augmentation at least 1 day prior to the treatment.

Photographic assessment was performed using the standardized Canfield imaging system that allows matching of pre- and postoperative frontal view images at 45- and 90-degree angles (Omnia, Canfield Scientific Inc., Fairfield, NJ). Preoperative images were compared with simulated images indicating realistically achievable treatment results so that an informed decision could be made by the patient as to whether to opt for filler injections or surgical rhinoplasty (►**Fig. 1**). In some cases of surgical rhinoplasty, we have observed low levels of patient satisfaction because preoperative simulation for surgery did not sufficiently match the actual result. This is not generally the case with injection rhinoplasty as predictability using photographic simulation in most cases, especially for hump camouflage, augmentation, and columella elevation, is very high.

We selected the type of filler to be used based on levels of viscosity and elasticity.[1] CaHA seemed initially to be the most appropriate agent, particularly for structures such as the nasal dorsum that has thin connective tissue and firm adhesion to the underlying structures and thus requires greater extensibility. Furthermore, some investigators highlight the importance of low hydrophilic properties for application in the nasal area to reduce the risk of compression of dermal and subdermal vessels,[2] thereby favoring use of CaHA rather than HA.

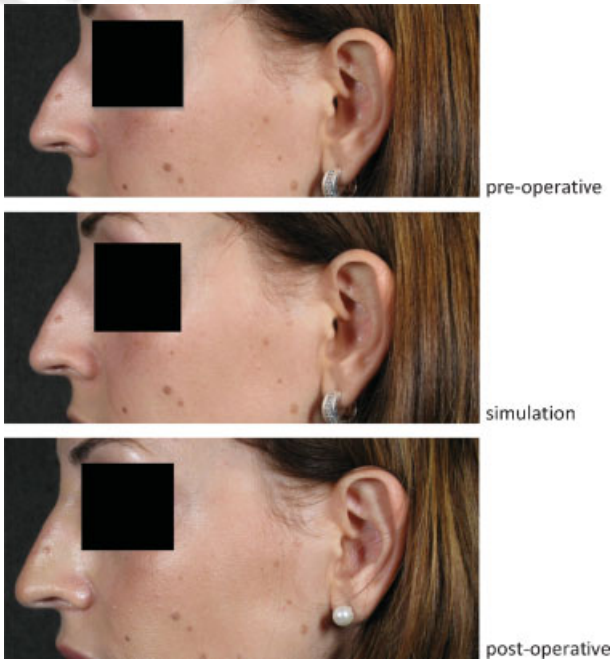

Fig. 1 Preoperative, simulated, and postoperative images, injection of 0.7 mL Juvéderm 4 in the radix area.

However, we observed two adverse effects in our first 20 patients, comprising filler displacement and erythema of the nose tip, which caused us to start using HA fillers as well (Juvéderm 4 and VOLIFT). Sixteen patients were treated with Juvéderm 4 and four patients with VOLIFT. Although the properties differ significantly between these two HA fillers —the former comprising a cohesive, 3D HA matrix dermal filler with local anesthetic; the latter using VYCROS technology, comprising an innovative combination of low- and high-molecular-weight HA to improve the cross-linking efficiency of HA chains[3]—they were not separately evaluated due to the small number of patients in the VOLIFT group. The decision as to whether to treat with CaHA or HA was reached according to the region to be treated. If augmentation of the columella was desired, we chose CaHA due to the higher-viscosity gradient that was believed to result in greater stability, while pure dorsum augmentation was performed with HA. However, a major complication associated with use of CaHA at the end of the observational period (see "Adverse Effects" section) led us to treat our remaining cases exclusively with HA.

Anesthetic ointment (i.e., 23% lidocaine-alkaline, 3.5% tetracaine-alkaline, 3.5% tetracaine-HCl, paraffin, Lipothene 133) was applied for 15 minutes prior to the procedure to the target treatment region; no other anesthetic measures were performed. The patient was then taken to the operating room, the anesthetic ointment was removed, and the skin area disinfected with Cutasept F (Propan-2-ol). The patient was placed horizontally with the upper part of the body slightly elevated. No marking of the treatment areas was performed to avoid camouflaging any irregularities. Visualization of the target zone was optimized by binocular head Loupes glasses (Eye Mag Smart Zeiss x2.5). Injection was performed either with a 23-gauge needle for CaHA or a 27-gauge needle for HA fillers. In both cases, fillers were injected craniocaudally deep into the superficial musculoaponeurotic system (SMAS) and sub-SMAS area. After positioning the needle, the syringe was aspired to eliminate any intravascular placement. Injection was performed retrogradely while simultaneously controlling the effect on the tissue volume. After needle removal, molding of the tissue was performed to achieve maximum homogenous distribution of the filler. This procedure was repeated if required and the patient was also involved by controlling the desired effect using a hand mirror.

After the procedure, cool packs were applied to the treated area for further 15 minutes and the patient was instructed to use ibuprofen and bromelain to mitigate against potential bruising for 3 days. A follow-up visit was scheduled for 1 week later, at which time volume was assessed and a repeat filler injection was administered if appropriate.

Fig. 2 Hump camouflage and nose tip elevation (pre- and postoperative), injection of 0.9 mL Radiesse in the radix, the dorsum nasi, and the columella.

Finally, patients were issued with a questionnaire 3 weeks and at least 9 months posttreatment asking them to rate their satisfaction with injection rhinoplasty according to a 5-point scale ("not at all" to "completely").

Results

Forty-six patients were treated over 3 years, 9 of whom underwent more than one treatment, up to a maximum of three consecutive treatments. Some patients were treated in more than one area, each of which were separately evaluated, so in total 88 areas were treated. Regarding the type of filler used, Radiesse (CaHA) was administered in 26 patients, and Juvéderm 4 or VOLIFT (HA) in 20 patients.

Patients were questioned about their motivation to undergo the procedure. Thirty-two wanted to improve an aspect of their nose but did not wish to undergo surgery, seven patients presented following unsuccessful surgical rhinoplasty, whereas seven patients were considering rhinoplasty but wanted to try a nonsurgical procedure before committing. Four patients elected to undergo surgical rhinoplasty at this point. Indications for treatment were as follows:

- Correction of a hump (radix and/or dorsum augmentation): 48 treatments
- Columella elevation, nose tip elevation, shortening of the nose: 16 treatments
- Camouflage of a twisted nose: 5 treatments
- Adjustment of grooves due to cartilaginous bony irregularities: 7 treatments
- Nose augmentation and/or tip molding: 12 treatments

Hump Reduction and/or Columella Elevation

Hump camouflage was performed in 12 patients and was combined with a nose tip elevation or nose shortening in 16 patients. For 17 patients, CaHA was the filler of choice and HA was used in 11 patients. The needle was introduced craniocaudally below the radix nasi and the injection was performed retrogradely. Care was taken to preserve a reasonable amount of the nasofrontal groove so that the hump was resolved completely (►**Fig. 2**). Management of pollybeak deformation (i.e., overprotection of the cartilage dorsum in relation to the bony dorsum) was achieved by columella elevation and equalization of the cartilage bony transition using 0.7- to 1.3-mL filler (►**Fig. 3**).

Camouflage of Twisted Nose

Harmonization of a twisted nose requires equalization of the concave side of the deformity. The needle entry point is positioned cranially of the concavity, the skin is elevated, and the needle inserted deep into the sub-SMAS, just superior to the periosteum or perichondrium. After aspiration, the needle is gently withdrawn and injection is performed caudocranially in a retrograde manner. The volume of filler required is evaluated by direct vision with the binocular Loupes glasses and palpation. Five patients were treated for

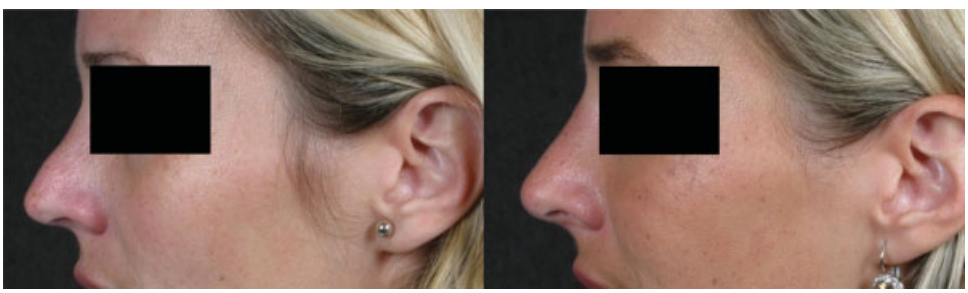

Fig. 3 Correction of a pollybeak deformity (pre- and postoperative),injection of 1.1 mL of Juvéderm 4 in the radix area, in the dorsum nasi, and in the columella.

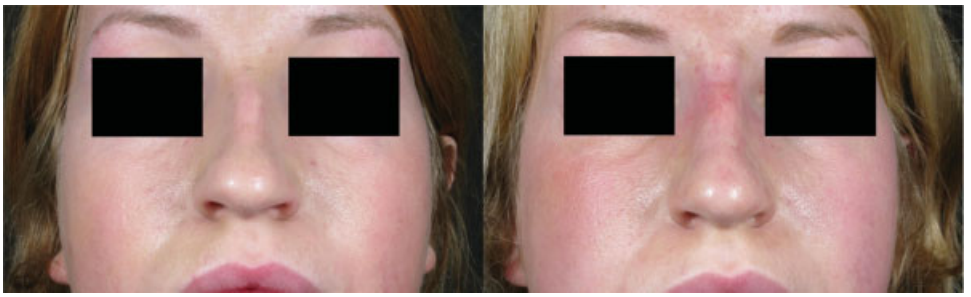

Fig. 4 Correction of a twisted nose (pre- and postoperative),injection of 0.9 mL Radiesse in the radix area, in the dorsum nasi, and in the right lateral pyramid wall.

Fig. 5 Equalization of grooves due to cartilaginous irregularities (pre- and postoperative), injection of 1.0 ml Juvéderm 4 in the grooves between the alar cartilages.

this deformity and the amount of filler used varied between 0.5 and 0.9 mL (►**Fig. 4**).

Adjustment of Grooves due to Cartilaginous Bony Irregularities

Equalization of the grooves between the cartilage skeleton is an effective indication for harmonizing the nose, particularly because the surgical alternative is difficult and does not generally lead to a successful outcome. Five patients were treated for this indication using between 0.6- and 1.1-mL filler (►**Fig. 5**). Bony irregularities occurring following rhinoplasty were treated in two cases.

Augmentation of the Dorsum (Saddle Nose)

Three patients presented with a saddle nose that is effectively treated with injection rhinoplasty, resulting in a smooth, even surface. We administered between 0.7- and 0.9-mL filler volume (►**Fig. 6**).

Nose Augmentation, Tip Augmentation, and/or Optical Nose Thinning

We performed this procedure in five patients. The nose tip is treated together with the columella by inserting the needle between the medial crura of the alar cartilage, then moving on to the tip defining point. Again, the filler material is inserted retrogradely, and placement between the medial crura allows a firm encapsulation of the filler within a defined structure, resulting in a stable correction and projection of the nose tip. The total amount of filler administered was between 1.3 and 1.7 mL. Tip molding was performed in combination with columella elevation and adjustment of cartilage grooves in seven patients (►**Fig. 7**).

Patient Satisfaction Questionnaire

All 46 patients provided feedback within 3 weeks of undergoing treatment. Sixty-three percent were completely satisfied, 22% were satisfied, and 15% were dissatisfied with

Fig. 6 Correction of a saddle nose (pre- and postoperative), injection of 1.2 mL Juvéderm 4 in the radix area and the dorsum nasi.

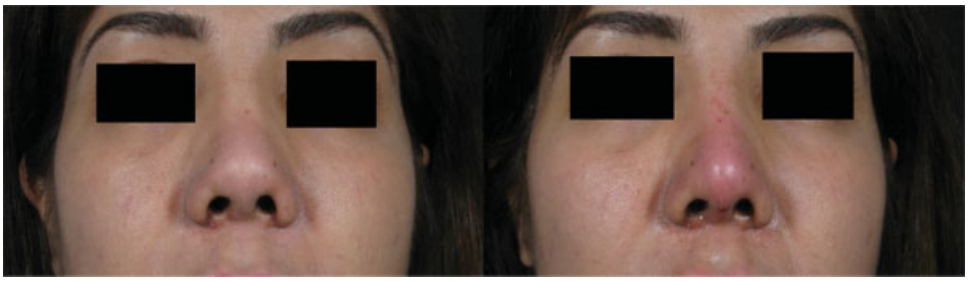

Fig. 7 Nose augmentation and thinning of the nose tip (pre- and postoperative), injection of 1.3 mL Juvéderm 4 in the radix area, dorsum nasi, tip of the nose, and the columella.

treatment. Thus, 85% of patients were satisfied with the short-term treatment results. Only 15 patients returned the questionnaire 9 months or later after treatment, 87% of whom confirmed they were very or completely satisfied with the results of injection rhinoplasty, regardless of the type of filler used. Ten patients confirmed they would repeat the procedure (four were undecided and one would not undergo repeat treatment). In those cases where patients were dissatisfied or not completely satisfied, this was commonly due to loss of volume that had occurred since treatment (73%). Indeed, treatment longevity varied considerably, ranging between 6 and 30 months (mean 13.5 months) (►**Fig. 8**). Eight patients (53%) said they would recommend treatment to others, four (27%) were likely and three (20%) would probably recommend treatment.

The overall positive evaluation was mainly due to the high level of predictability of the result and the ability to simulate the desired outcome to meet patient expectations. This is particularly the case for refining the nose profile, that is, humps, saddle nose, and columella elevation. Of the 35 patients treated for nose profile correction, 27 were completely satisfied (77%), 7 were moderately satisfied (20%), and 1 patient was dissatisfied (3%). Least patient satisfaction was associated with nose augmentations, molding of the nose tip, and isolated columella elevations in which eight patients (66%) were dissatisfied and four patients (33%) were only averagely satisfied.

Regarding patient assessment of the injection procedure, 29 patients were fully satisfied and stated that the procedure met the expectations completely, especially with respect to the preoperative counseling and simulation tool (63%) (10 patients [22%] were satisfied; 7 patients [15%] were dissatisfied).

Adverse Effects

Reported complications after nonsurgical rhinoplasty are generally restricted to minor adverse effects, such as erythema, local inflammation, swelling, and bruising. Local erythema after injection is almost unavoidable, and administration of anti-inflammatory drugs and application of cool packs usually leads to prompt recovery within hours.

Minor adverse effects in this study comprised one case of filler dislocation, two cases of visible hematoma, and one case of subcutaneous nodules persisting for up to 8 weeks after CaHA injection. However, we also observed one moderate and two severe complications, all following CaHA treatment. The first was a 35-year old man treated for a hump, cartilaginous grooves, and abnormal projection of the columella who presented with a painless red nasal tip 2 weeks posttreatment. Treatment was given with topical corticosteroid (Ecural [Mometasone 17-(2-furoate)]) and cefuroxime antibiotics and resulted in complete remission after 4 weeks (►**Fig. 9**). The second case was a 48-year-old woman presenting for a dorsum correction after rhinoplasty 15 months previously. We administered 0.4 mL CaHA in the area between the alar and lateral cartilage of the dorsum. As the patient lived some distance from the clinic, we recommended cefuroxime 250 mg as prophylaxis, but she rejected this advice. She presented the following day with local infection at the injection site and punctate skin lesions were observed. Local treatment comprised disinfection with Octenisept and hydrogen peroxide 4%, and Aureomycin antibiotic ointment. The patient insisted on returning home, but 72 hours later she sent photographs that indicated skin necrosis. We arranged a consultation at a local ENT and facial plastic surgery department whereupon necrosis was not confirmed, but extensive infection was diagnosed

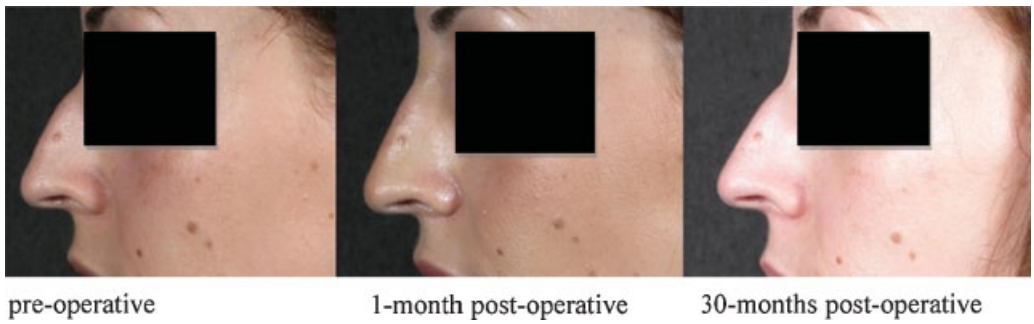

Fig. 8 Treatment longevity of up to 30 months, injection of 0.7 mL Juvéderm 4 in the radix area.

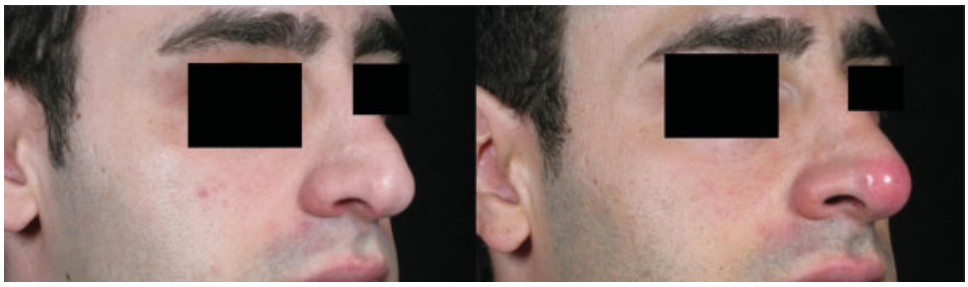

Fig. 9 Painless red nasal tip 2 weeks posttreatment, injection of 1.3 mL Radiesse in the radix area and the columella.

and it was recommended that in-patient treatment was required. The patient rejected this advice and no further information on follow-up was available (►**Fig. 10**). The third case was a 53-year-old man who underwent several CaHA injections for nose augmentation over the past 5 years, the last of which was with 0.4 mL CaHA 12 months ago. He also underwent corrective surgical rhinoplasty that involved insertion of a polyethylene Medpor splint. There were no reported infections following these treatments. He presented with a history of a blocked nose persisting for approximately 2 weeks, with no obvious signs of infection. Endoscopic inspection revealed a dislocated splint that had protruded through the mucosa of the left nasal cavity and the nose tip revealed a subdermal abscess with skin necrosis (►**Fig. 11**). The abscess was incised, pus removed (microbiological examination indicated staphylococcal infection), and the cavity was cleaned with hydrogen peroxide 4% and ciprofloxacin. This treatment was repeated daily for 10 days, together with oral ciprofloxacin 750 mg twice a day. The splint was shortened under local anesthesia but not removed as per the patient's request. Following treatment, the infection resolved completely and the splint was covered by a layer of mucosa.

Discussion

Injectable biodegradable fillers are a safe and effective alternative to surgery for correction of minor nasal deformities or irregularities either as primary procedure (primary rhinoplasty) or secondary to surgical rhinoplasty with residual unevenness (revision rhinoplasty). In this study, 46 patients were treated (26 with CaHA, 20 with HA). There was a high level of patient satisfaction 3 weeks posttreatment (85%); however, only 15 patients returned the questionnaire 9 months or later posttreatment, but of these, 63% indicated they would repeat the procedure and 80% would recommend the procedure to others. Lack of satisfaction was largely due to complete or partial loss of the initial volume over time (73%). The overall positive assessment was related to the very fast and mostly painless (62%) procedure, which offsets the temporary nature of the result. Treatment longevity was very variable, ranging between 6 and 30 months.

Most practitioners agree that biodegradable fillers should be used in preference to permanent fillers for safety reasons, although some authors still favor permanent fillers.[4] In our study we assessed safety of the procedure, as there are potential disastrous complications that can occur, such as amaurosis after injection of fillers, fat,[5] or local anesthesia,[6] probably due to accidental intra-arterial injection with subsequent occlusion of the central retinal artery or its branches. Similar complications have been reported following septoplasty and rhinoplasty.[7,8] Therefore, it is important not to exert excess force when injecting and attention should be paid to the needle size, as well as the viscosity and particle size of the filler.[9] This is a particular issue when comparing CaHA and

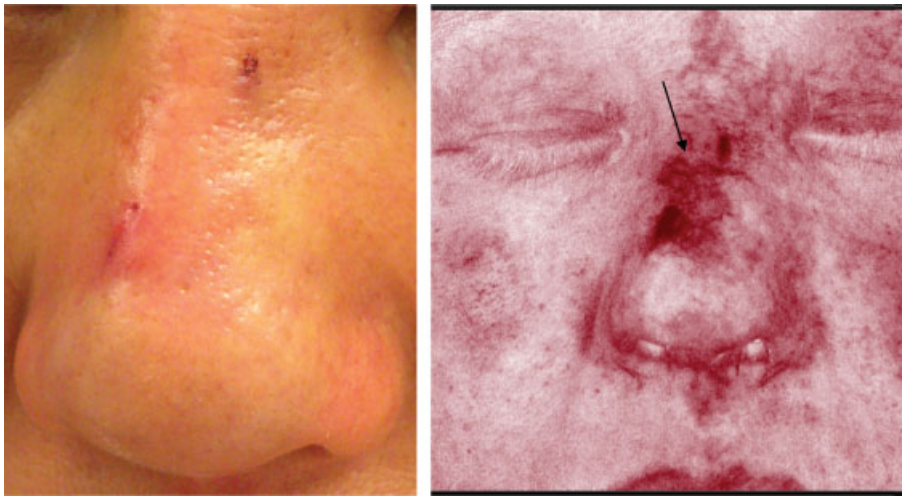

Fig. 10 Punctate skin lesions evident on first postoperative day after calcium hydroxyapatite (CaHA) injection of the dorsum (*left*), and cross-polarized light showing hyper- and hypoperfusion in the tip area indicated by the arrow (*right*).

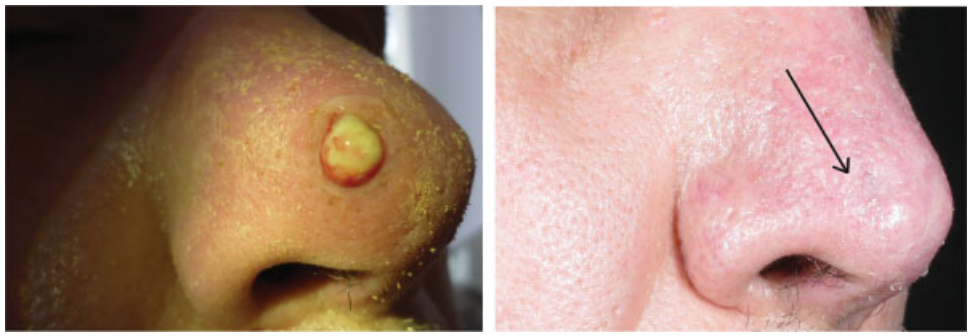

Fig. 11 Pus penetrating through the nasal tip (*left*), and residual scar (*arrow*) after local treatment, multiple previous injections of Radiesse in the dorsum nasi, and surgical rhinoplasty.

HA fillers, as CaHA is harder to inject due to its higher viscosity, and therefore higher pressure has to be applied than with HA fillers, resulting in use of thicker needles. In our study, 23-gauge needles were used to inject CaHA, whereas 27- and 30-gauge needles were used to inject HA.

All authors concur about injection technique that comprises syringe aspiration, retrograde injection, reduction in injection pressure, avoidance of bolus injection, application of topical vasoconstrictors pretreatment, use of blunt needles, sub-SMAS injection, and compression of the angular artery.[10] We would also recommend a superior-inferior injection technique into the nasion and dorsum of nose following the longitudinal vessels of the dorsum from the fixed (superior) to the more flexible (inferior) region. This technique means that vessels tend to be pushed away by the needle so it is unlikely they will be punctured accidentally, whereas the subcutaneous areas of the nasion and the lateral walls of the pyramid have a distinctly firmer adhesion that reduces the ability of the arteries to shift away. It is important to document the technique used in case of subsequent complications.[11] In the unlikely event of microembolism and vision loss following HA treatment, hyaluronidase should be the first-line treatment as it is an enzyme that catalyzes the hydrolysis of HA and has been shown to degrade intravascular HA.[12] There is no similar dissolving agent known for CaHA, with most practitioners favoring reperfusion of the occluded vessels with oxygen, topical application of Nitropaste,[2] intravenous diuretics, corticosteroids and antibiotics, carbogen and hyperbaric oxygen inhalation, plus lysis therapy.[13]

Infections or necrosis have been reported following application of HA in the glabella and nose.[14,15] In this study we observed three cases of infection after CaHA administration; no infection/necrosis was observed in patients treated with HA. Two cases resolved completely following treatment, but one case was lost to follow-up. However, because of the high number of complications associated with CaHA (10.7%), we decided to use HA rather than CaHA for future injection rhinoplasty, particularly because it has the potential for immediate degradation using hyaluronidase.

In conclusion, injection rhinoplasty with CaHA and HA biodegradable fillers for harmonization of minor nasal deformities, either as primary procedure (primary rhinoplasty) or secondary to rhinoplasty with residual unevenness (revision rhinoplasty), produces excellent results with high levels of patient satisfaction.

References

1 Sundaram H, Voigts B, Beer K, Meland M. Comparison of the rheological properties of viscosity and elasticity in two categories of soft tissue fillers: calcium hydroxylapatite and hyaluronic acid. Dermatol Surg 2010;36(Suppl 3):1859–1865

2 Jasin ME. Nonsurgical rhinoplasty using dermal fillers. Facial Plast Surg Clin North Am 2013;21(2):241–252

3 Bernardin A. VYCROSS™: An Innovative Dermal Filler Technology. Poster Presentation at Anti-aging Medicine European Congress (AMEC), Monte Carlo; 2013

4 Rivkin A. A prospective study of non-surgical primary rhinoplasty using a polymethylmethacrylate injectable implant. Dermatol Surg 2014;40(3):305–313

5 Lazzeri D, Agostini T, Figus M, Nardi M, Pantaloni M, Lazzeri S. Blindness following cosmetic injections of the face. Plast Reconstr Surg 2012;129(4):995–1012

6 Cheney ML, Blair PA. Blindness as a complication of rhinoplasty. Arch Otolaryngol Head Neck Surg 1987;113(7):768–769

7 Leng T, Moshfeghi DM. Branch retinal artery occlusion after septoplasty. Ophthalmic Surg Lasers Imaging 2010 Dec 1;41 Online:e1-e2

8 Kim EG, Eom TK, Kang SJ. Severe visual loss and cerebral infarction after injection of hyaluronic acid gel. J Craniofac Surg 2014;25(2): 684–686

9 Chen Y, Wang W, Li J, Yu Y, Li L, Lu N. Fundus artery occlusion caused by cosmetic facial injections. Chin Med J (Engl) 2014; 127(8):1434–1437

10 Saban Y, Andretto Amodeo C, Bouaziz D, Polselli R. Nasal arterial vasculature: medical and surgical applications. Arch Facial Plast Surg 2012;14(6):429–436

11 Kim SK, Hwang K. A surgeon's legal liability of compensation for blindness after periorbital fat grafts. J Craniofac Surg 2013;24(3): 970–971

12 DeLorenzi C. Transarterial degradation of hyaluronic acid filler by hyaluronidase. Dermatol Surg 2014;40(8):832–841

13 Schumacher M, Schmidt D, Jurklies B, et al; EAGLE-Study Group. Central retinal artery occlusion: local intra-arterial fibrinolysis versus conservative treatment, a multicenter randomized trial. Ophthalmology 2010;117(7):1367–75.e1

14 Matarasso SL, Carruthers JD, Jewell ML; Restylane Consensus Group. Consensus recommendations for soft-tissue augmentation with nonanimal stabilized hyaluronic acid (Restylane). Plast Reconstr Surg 2006;117(3, Suppl):3S–34S, discussion 35S–43S

15 Kurkjian TJ, Ahmad J, Rohrich RJ. Soft-tissue fillers in rhinoplasty. Plast Reconstr Surg 2014;133(2):121e–126e