Asian Rhinoplasty: Preoperative Simulation and Planning Using Adobe Photoshop

Kidakorn Kiranantawat, MD, FRCST¹ Anh H. Nguyen, MD²

¹Department of Surgery, Mahidol University, Bangkok, Thailand

²Department of Surgery, Baylor College of Medicine, Houston, Texas

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Address for correspondence Kidakorn Kiranantawat, MD, FRCST, Division of Plastic and Maxillofacial Surgery, Department of Surgery, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand (e-mail: kidakorn.plasticsurgery@gmail.com).

Abstract

Keywords

- Asian rhinoplasty
- computer imaging
- simulation
- rhinoplasty
- photoshop

A rhinoplasty in Asians differs from a rhinoplasty performed in patients of other ethnicities. Surgeons should understand the concept of Asian beauty, the nasal anatomy of Asians, and common problems encountered while operating on the Asian nose. With this understanding, surgeons can set appropriate goals, choose proper operative procedures, and provide an outcome that satisfies patients. In this article the authors define the concept of an Asian rhinoplasty—a paradigm shift from the traditional on-top augmentation rhinoplasty to a structurally integrated augmentation rhinoplasty—and provide a step-by-step procedure for the use of Adobe Photoshop as a preoperative program to simulate the expected surgical outcome for patients and to develop a preoperative plan for surgeons.

Augmentation rhinoplasty using alloplastic material has been the most popular technique in Asia for decades. Despite several studies reporting acceptable complication rates and patient satisfaction,^{1,2} most studies followed patients for less than 1 year, and implant visibility or stick-like deformity were not included as complications. In our experience with revision rhinoplasty patients, the majority of reasons for the revision rhinoplasty has been an unnatural appearance, a visible implant, or a stick-like deformity. Years after surgery, these unpleasant outcomes become more apparent in higher percentages as the soft tissue envelope is gradually thinner due to forces interacting between the implant and surrounding tissue. Therefore, we believe that with on-top augmentation using an alloplastic implant, the ideal Asian nose is rarely achieved in the long term.

Beauty Concept of Rhinoplasty

In contrast to Caucasians, the problems of Asian noses include a low dorsum, low radix, bulbous tip, underprojected tip, hanging alar, and an upturn.³ Surgeons who perform Asian rhinoplasties deal with noses with weak structures and deficient volume; therefore, adding materials for volume and support is a necessity. Currently, there are three types of

materials commonly used in augmentation rhinoplasty: (1) alloplastic implants, (2) autologous grafts, and (3) homologous grafts.⁴ The nose is a complex structure composed of two major components: a three-dimensional framework and a soft tissue envelope. For the nasal framework—to make things more obvious in terms of structure—we could compare the nose with a house. The low-profile nose of Asians is comparable to a short house as shown in ►Fig. 1. Most of the augmentation rhinoplasty procedures typically done decades ago are similar to putting things on top of the roof (►Fig. 2A); we call this “on-top augmentation.” ►Fig. 2A demonstrates the effect of on-top augmentation to a house, compared with the ideal house (►Fig. 2B). Undoubtedly, it makes a house taller, but the whole house looks strange or unnatural: The new “on-top” house and its components are disproportionate. The whole new house is tall, but the old doors and windows (comparable to nostrils) are still low and short. Often, the augmented roof is too heavy, and the framework of the house is not able to bear the weight. All the structures below the roof, including doors and windows (comparable to nostrils), are proportionally deformed. ►Fig. 3 demonstrates profile and basal views of the nose after on-top augmentation with a silicone implant. Although the nose has a high or higher projection, it is not considered a beautiful nose. Both nostrils

Fig. 1 Short house is used to illustrate a low-profile nose commonly found in Asians.

Fig. 2 (A) Unnatural results of “on-top augmentation.” The house and its components are disproportionate. The new house is tall, but the old doors and windows (comparable to nostrils) are still low and short. (B) Ideal normal house. The house and all of its structures are tall with proper proportions.

Fig. 3 (A,B) Profile and basal views of the nose after on-top augmentation with a silicone implant. Despite the nose's high projection, it is not considered an ideal nose. Both nostrils are deformed and distorted due to the pressure effect of an implant on both lower alar cartilages.

are deformed and distorted due to the pressure effect of the implant on both lower alar cartilages. Therefore, we encourage plastic surgeons to be familiar with “structurally integrated augmentation rhinoplasty,” which is similar to rebuilding a house by incorporating materials to truly change its internal structure, and not just the external onlay. Structurally integrated augmentation is able to be done with both open and endonasal approaches. To achieve a satisfactory outcome for both patients and surgeons, knowing the “beautiful normal” and preoperative planning are among the first steps to begin.

“Know the ideal beautiful normal,” as stated by D. Ralph Millard, Jr., MD, is still the most important principle in both cosmetic and reconstructive surgery.⁵ Therefore, it is a must for all surgeons to fully understand the Asian concept of beauty, normal Asian anatomy, and the proportions of the Asian nose. In the past, similar to Asian eyelid surgery, for patients and surgeons the goal of Asian nose surgery was the Caucasian look. However, over time, people realized that a Caucasian-like nose makes Asians look unnatural. As a result, the trend has shifted toward a unique normal ideal for Asians.

The ideal Asian nose is difficult to define. However, first, it needs to be normal: The morphology and proportion should be common and typically found. Second, it is not a single type or particular morphology, but a range or spectrum. If surgeons apply similar fixed standard nose measurements, many will have similar looks. Third, beauty like fashion changes over time. Therefore, surgeons need to understand the trends and extrapolate important and long-lasting features from those trends. Lastly, even the most beautiful nose in the world may not “fit” an individual. The surgeon and patient have to discuss and adjust their goals together to get the results that will satisfy both. To demonstrate the surgeon's ideas, preoperative simulation using computer imaging is helpful in both primary and revision rhinoplasty.

Preoperative Simulation

In previous decades, it was uncommon for surgeons to use computerized modification of preoperative images to simulate the expected outcome: (1) Many surgeons were not familiar with the technology; (2) most of the software was expensive; (3) there was a learning process and additional time was needed in the consultation; and (4) there were potential medicolegal implications in cases where the final outcome of the rhinoplasty fell short of the expected image.⁶ Therefore, surgeons either drew or verbally explained the expected outcome to patients. As we all know, drawings and verbal explanations are not always clear; patients create an image using their own imagination. Often, the final image that the patient expects and the image in the surgeon's mind are not the same. This difference is often impossible to discover until after the surgery. This could create patient dissatisfaction, which sometimes leads to a medicolegal issue as well.

Today, computer technology and access are readily available. Most people, including plastic surgeons and patients, have grown up with this technology and are familiar with it. People realize that computer imaging and real life are different. Therefore, most patients easily accept the fact that the result of surgery

might not be exactly the same as preoperative simulated images. Educated patients are able to understand that there are many factors influencing the surgical outcome especially revision rhinoplasty. Factors include scar, destroyed structures from previous surgery, anatomical limitation, etc. According to our experience using Adobe Photoshop (Adobe Systems, Inc., San Jose, CA) as a preoperative simulator for more than 5 years, more than 95% of the patients found it helped communication and promoted understanding (unpublished data).

Preoperative Photo Simulation Using Adobe Photoshop

The patient face is photographed as recommended in the guideline, The Photographic Standards in Plastic Surgery published by the American Society of Plastic Surgeons and the Plastic Surgery Educational Foundation.⁷ Seven principal views for critically evaluating the nasal morphology pre- and postoperatively include frontal, basal, oblique (right and left), lateral (right and left), and smile. One more photo that is routinely taken for preoperative simulation and planning is a profile view with a ruler as demonstrated in ▶Fig. 4.

During the consultation, the profile view-with-ruler photo is opened with Adobe Photoshop (▶Fig. 5). Duplication of the patient's photo is created in the second layer using the command key and “j” key (▶Fig. 6). The newly created second layer is modified by the “liquify” photo filter (▶Fig. 7) or by pressing the command, shift, and “x” keys together. After selecting the liquify filter, a new window will pop up (▶Fig. 8)

Fig. 4 Preoperative photo: profile view with ruler. This photo allows the surgeon to get a precise measurement of differences between modified and original images.

Fig. 5 The profile view with ruler-photo as opened in Adobe Photoshop. This layer is automatically named “Background” layer.

Fig. 6 Duplication of the patient's photo is created in the second layer using the command key and the “j” key. The new layer is automatically named “Layer 1.”

Fig. 7 The “Liquify” menu is demonstrated.

Fig. 8 After selecting the liquify filter, a new window will pop up. A surgeon can morph the appearance of the nose until both the patient and the surgeon are satisfied.

and the circular morphing brush will appear. The size of the brush can be adjusted by pressing “[” and “]” keys, to reduce and enlarge the brush size, respectively. Photo morphing is done until both the patient and surgeon are satisfied. While performing the photo morphing, a surgeon needs to know the possibilities and limitations of the actual surgery versus the created photo. It is a must to tell the patient if his or her goal is impossible. For example, a patient who underwent several rhinoplasty operations may have severe fibrotic scars inside and a less-pliable soft tissue envelope. This must be addressed by both the patient and the surgeon during history-taking and physical examination. After fine tuning is done between patient's desire and reality according to the surgeon's experience, the best possible simulated photo is created. The other useful way is to create many layers of photographs; photos in each layer can be morphed individually. Several expected outcomes can then be demonstrated to the patient by clicking the small box and opening the eye icon in front of each layer (► Fig. 9). Afterward, the patient can spend time reviewing the images and choose a goal on his or her own.

Preoperative Planning Using Adobe Photoshop

After the photo of the expected nose is created as a “modified nose” layer, it is duplicated to a “blueprint” layer. The eye icon in front of the “modified nose” layer is clicked to make the layer invisible. The “blueprint” layer then reduces the opacity to 50%, so that the difference between preoperative and expected noses is visualized (► Fig. 10).

The size of the whole canvas is then adjusted by pinching in and out on the trackpad until the scale on the ruler is 1:1. After that, all dimensions of the difference between the preoperative and modified noses are directly measured on the computer screen.

A text layer is created. The details of the operative plan are then typed. During surgery, a surgeon can either bring his laptop or print the blueprint layer and bring it into the operating room. Thus, the blueprint may be used as a reference during surgery.

With this procedure, we found that all steps of surgery are more precise. The shape and angle of the caudal septal extension graft, and the shape and dimension of the implant or cartilage graft for dorsal augmentation are precisely defined in millimeters.

Evaluation of Postoperative Results

Apart from the side-by-side comparison of preoperative and postoperative photos, a profile view of the patient's postoperative photograph may also be superimposed over the preoperative simulation photo by inserting it as another layer on top of the “modified nose” layer, then the opacity of the above layer is reduced. The difference between preoperative simulation photo and the actual surgical result can be visualized as shown in ► Fig. 11. The surgeon can precisely measure the difference between preoperative plan and the end result. We found this to be very helpful feedback, leading to improvement and refinement of the operation for subsequent patients.

Fig. 9 Multiple types of nose can be created as multiple layers. The name of each layer can be changed to describe each modification. The layer is visible as the eye icon appears in the small box in front of the layer's name.

Fig. 10 The “Blueprint” layer is created by duplication of the “Modified Nose” layer. The opacity of the Blueprint layer is then reduced to 50%, so that the difference between preoperative and the projected nose is visualized.

Fig. 11 A profile view of the patient’s postoperative photograph is superimposed over the preoperative simulation photo by inserting it as another layer on top of the Modified Nose layer. The difference between the preoperative simulation photo and the actual surgical result is then visualized.

Fig. 12 Preoperative simulated photo of Case 1.

Case Example

Case 1: Primary Rhinoplasty with Conchal Cartilage

A 30-year-old woman sought correction of her prominent ears and the appearance of her nose. She had no difficulty breathing. She had no chronic illness or any previous facial surgery. A preoperative simulated outcome photo was created with the agreement of both the patient and surgeon using Adobe Photoshop (►Fig. 12). Her operative plan is shown in ►Fig. 13. The operative procedure was as follows: conchal cartilage harvest together with conchal reduction and prominent ear correction; an open rhinoplasty; a septoplasty with septal cartilage harvest; placement of bilateral nonvisible spreader grafts (taken from conchal cartilage); placement of a caudal septal extension graft (CSEG), which was taken from the nasal septum; bilateral hinge complexes release; cephalic trim of the lateral crura of both lower alar cartilages (LLCs); a transdomal suture; an interdomal suture anchored to the tip of the CSEG; a medial crural suture; a tip graft (taken from conchal cartilage); and an internal approach osteotomy and in-fracture of both nasal bones to narrow down the nasal bony base. Comparisons between pre- and postoperative photos at 7 months after surgery are shown in ►Fig. 14. The procedures were successful, and the patient was satisfied with the outcome.

Case 2: Primary Rhinoplasty with Hybrid Technique (Costal Cartilage and Silicone Implant)

A 21-year-old woman wanted to improve the appearance of her nose. She had no functional problems. Preoperative photo

Fig. 13 Blueprint layer and preoperative plan of Case 1.

Fig. 14 (A–D) Case 1: Preoperative and postoperative photos at 7 months.

Fig. 15 Case 2: Preoperative simulated photo.

Fig. 16 Case 2: Preoperative plan.

Fig. 17 (A–D) Case 2: Preoperative and postoperative photos at 2 years.

morphing was done using Adobe Photoshop as shown in ►Fig. 15. A photo of the blueprint layer is shown in ►Fig. 16. An augmentation rhinoplasty was performed under general anesthesia. Steps of operative procedure are as follows: costal cartilage harvest through a right inframammary crease incision, an open rhinoplasty, bilateral spreader grafts, a CSEG (fixed to spreader grafts as tongue-and-groove fashion), hinge complex release (disconnection of both lateral crura from the pyriform aperture), a transdomal suture, an interdomal suture fixed both LLC domes to the tip of the CSEG, a tip graft, a medial crural suture, insertion of an i-shaped silicone implant for dorsal augmentation, a lateral crural spanning suture, V-Y advancement of both vestibular skin and alar contour grafts (correction of a retracted alar, which is a consequence of massive caudal rotation of the tip), and chin-implant insertion through lower gingivobuccal sulcus incision. During closure of the wound, the skin envelope at the tip was tight and tip perfusion was impaired. The tip projection was then reduced from the preoperative plan to avoid tip necrosis. Comparisons between preoperative and 2-year postoperative photos are provided in ►Fig. 17. Although the surgical outcome did not meet the preoperative plan, the patient understood the surgical limitation and was happy with the result.

Case 3: Revision Rhinoplasty with Septal Cartilage

A 38-year-old woman requested a revision rhinoplasty. She had augmentation rhinoplasty with an L-shaped silicone implant 3 years ago; she was not happy with the result because of too-high radix, the absence of frontonasal angle,

a stick-like deformity, a too-thick infratip lobule, and a too-wide columella-labial angle. Photo morphing using Adobe Photoshop was performed (►Fig. 18). The blueprint layer is shown in ►Fig. 19. Operative details were as follows: an open rhinoplasty, old silicone implant removal (the implant was found to be 3-mm thick, which was equal to the preoperative plan of a 3-mm reduction of the nasal dorsum), removal of posterior capsule flap at the supratip area, internal fibrotic scar removal, septal cartilage harvest, attachment of a CSEG to the caudal septum, cephalic trim of the lateral crus of both LLCs, a transdomal suture, an interdomal suture, fixation of both LLC domes to the tip of the CSEG, a medial crural suture, a tip graft, an alar contour graft, V-Y vestibular advancement (correction of the retracted alar after caudal rotation of the tip), minimal augmentation of the radix with diced cartilage, and an internal osteotomy of both nasal bones (to narrow down the bony base). Comparisons between pre- and post-operative photos at 4 months after surgery are shown in ►Fig. 20.

Case 4: Secondary Rhinoplasty with Hybrid Technique (Costal Cartilage and Silicone Implant)

A 27-year-old woman underwent on-top augmentation rhinoplasty with an L-shaped silicone implant 5 years ago. She complained of an unnatural appearance; she thought it was upturned and had an underprojected tip. She also wanted to have her dorsal bridge to be more projected if possible. She had no breathing difficulty or other functional problems. During the preoperative consultation, photo morphing using Adobe Photoshop was

Fig. 18 Case 3: Preoperative simulated photo.

Fig. 19 Case 3: Blueprint layer and preoperative plan.

Fig. 20 (A–D) Case 3: Preoperative and postoperative photos at 4 months.

Fig. 21 Case 4: Preoperative simulated photo.

Fig. 22 Case 4: Blueprint layer and preoperative plan.

Fig. 23 Case 4. (A) Intraoperative photo demonstrates L-shaped silicone implant and fibrotic scar over lower alar cartilages (LLCs). (B) Previously placed L-shaped silicone implant.

Fig. 24 (A–E) Case 4: Preoperative and postoperative photos at 2 months.

used as a medium to communicate and fine-tune her ideal look. An outcome image was created with the agreement of both the patient and the surgeon (►Fig. 21). The blueprint layer is shown in ►Fig. 22. The operative plan was as follows: an open rhinoplasty, costal cartilage harvest from a right inframammary crease incision, old L-shaped implant removal (►Fig. 23), removal of the posterior half of the implant capsule, internal fibrotic scar removal, placement of a CSEG attached to the left side of the septum, hinge complex release of both lateral crura to facilitate the caudal rotation of both LLCs, repair of torn medial crus of the left LLC, cephalic trim of the lateral crus of both LLCs, a transdomal suture, an interdomal suture transfixed to the tip of the CSEG, the placement of a tip graft, insertion of new i-shape silicone implant into newly created subperiosteal pocket, placement of bilateral alar contour grafts, and insertion of a chin implant through a lower gingivobuccal sulcus incision. Comparisons between preoperative and 2-month postoperative photos are provided in ►Fig. 24. Although the tip projection was a bit more than the preoperative simulated photo, the patient acknowledges a significant improvement in her appearance and is very satisfied with her surgical outcome.

Case 5: Fifth Rhinoplasty with Hybrid Technique (Costal Cartilage and Silicone Implant)

A 40-year-old woman sought improvement of her nose appearance. She complained of a stick-like deformity and

Fig. 26 Case 5: Blueprint layer and preoperative plan.

Fig. 25 Case 5: Preoperative simulated photo.

an unnatural upturned tip. People could easily notice her nose implant under her thin skin envelope. She had had four rhinoplasties. In the last surgery, the surgeon changed from a silicone implant to a polytetrafluoroethylene (PTFE) implant. Along with the previous rhinoplasty, the patient also received an excessive hyaluronic acid injection into her forehead. During the preoperative consultation, the expected outcome was created (►Fig. 25). The preoperative

Fig. 27 Case 5: Caudal septal extension graft (CSEG), taken from costal cartilage, attached to the caudal part of the native nasal septum.

Fig. 28 (A–E) Case 5: Preoperative and postoperative photos.

plan is provided in ►**Fig. 26**. The operative procedure was as follows: forehead filler removal (hyaluronidase enzyme injection followed by aspiration), costal cartilage harvest, an open rhinoplasty, removal of fibrotic scar and old PTFE implant, placement of a CSEG attached to the caudal septum (►**Fig. 27**), cephalic trim of the lateral crura of both LLCs, a transdomal suture, an interdomal suture, fixation of both domes to the tip of the CSEG, a medial crural suture, insertion of a new i-shaped silicone implant into the subperiosteal plane, a lateral crural spanning suture, and alar contour grafts. Comparisons between pre- and postoperative photos at 3 months after surgery are provided in ►**Fig. 28**. The patient's appearance improved and she was happy with her surgical outcome.

Conclusion

Rhinoplasty in Asians is different from the procedure normally performed in patients of other ethnicities. Surgeons must understand the Asian concept of beauty, nasal anatomy, and common problems encountered when operating on the Asian nose. With this understanding, surgeons can set appropriate goals, choose proper operative procedures, and provide an outcome that satisfies patients. Computerized preoperative simulation of rhinoplasty results using Adobe Photoshop is a helpful communication tool between patients and surgeons. Furthermore, it also helps surgeons to make a precise preoperative plan, thus increasing the chances for a successful rhinoplasty.

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