Nasal Analysis and Anatomy: Anthropometric Proportional Assessment in Asians—Aesthetic Balance from Forehead to Chin, Part II

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Abstract

Keywords

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Caucasians usually have reduction or correction rhinoplasty; however, Asian nasal surgery is mainly for augmentation rhinoplasty. Therefore, an Asian rhinoplasty should start with a precise understanding of ethnic anatomical differences. The authors summarize the anatomical characteristics of Asians to ensure the best results.

An Asian rhinoplasty can be a surgical challenge because of the diverse anatomy between different racial groups. Surgeons undertaking rhinoplastic surgery in non-Caucasian individuals need a broad understanding of ethnic-specific features.¹ Asian aesthetic goals should be patient-tailored to the ethnicity and culture of the individual patient.² Compared with Caucasians, Asians generally have a shorter, wider, and less-projecting nose, requiring augmentative and structural rhinoplasty, whereas reduction rhinoplasty and some form of lower lateral cartilage reduction is more popular in Caucasians with dorsal hump prominence.³

Morphology Classification

There are many types of Asian nose morphologies.⁴ Three broad morphological types have been used to describe the spectrum of ethnic variations. The leptorrhine (“tall and thin”) nose is associated with Caucasian or Indo-European descent. The platyrrhine (“broad and flat”) nose is associated with African origins. And the mesorrhine (“intermediate”) nose has features intermediate between the leptorrhine nose and the platyrrhine nose. The “typical” Asian or Latino nose is commonly regarded as mesorrhine, with low radix, variable

anterior dorsal projection, rounded and underprojected tip, and rounded nostrils.⁵

Ethnic Variation

One of the main features of the nonoperated Asian nose is a more triangular shape on the frontal view. When assessing the Asian nose from the side view, it is common to see a nasal bridge that is lower in height when compared with a Caucasian nose. Anatomical features of Asians include thicker skin, weaker cartilages, less dorsal projection, rounder tip and alae, and a more-retrusive columella.^{6,7} Another common feature of the Asian nose is a flared nasal base, with wider-than-average nostrils.

External Soft Tissue Envelope

The anatomical structures of the nose can be categorized in groups by anatomical layers. Surgical dissection between these structural planes is critical to preserving the anatomical structures. External coverage of the nose is composed of the skin, subcutaneous tissue, fibromuscular layer, and perichondrium or periosteum.⁸

Skin

The thickness and texture of the skin can have a significant effect on the result of the operation; therefore, it is important to evaluate patient skin characteristics during preoperative planning. Generally, nasal skin becomes more pliable and thinner in the upper portion, but tighter and more adherent in the lower portion.⁸ The mean skin thickness of the nasofrontal angle area is 1.25 mm—the thickest area. In contrast, the mean skin thickness of the rhinion is 0.6 mm—the thinnest area.⁹ Asian noses tend to have thicker skin and more abundant subcutaneous soft tissue than noses of Caucasians.⁸ Fibrofatty tissue is the dense structure that attaches to the underlying cartilage.¹⁰

Subcutaneous Layer

Four soft tissue layers are present between skin and the osseocartilaginous framework, consisting of the following:⁸

- 1. Superficial fatty layer panniculus
- 2. The fibromuscular layer (nasal SMAS) is basically an extension of the superficial musculoaponeurotic system (SMAS). The SMAS becomes retracted on both sides in the case of disconnection due to careless surgery or trauma; bone or cartilage is placed underneath the location that may be exposed. Moreover, the nasal SMAS may be directly adhered to the the superficial fatty layer and scar tissue attached to the dermis.
- 3. The deep fatty layer houses important vessels and a motor nerve, which are located at a shallow point. In surgery, it is easy and safe to elevate the external skin envelope at the lower portion of this deep layer of fat.
- 4. Periosteum or perichondrium

Intrinsic and Extrinsic Nasal Musculature

The nasal musculature is involved in facial expression, the variable motion of the nose, and nasal cavity control during respiration. The muscles involved can be broadly classified into intrinsic muscles and extrinsic muscles. They function by interrelating partially with each other. All of the aforementioned nasal musculatures receive innervation from the zygomatic division of the facial nerve. The intrinsic muscles of the nose are the nasalis and its lower portion: the dilator naris or the levator alae. The external muscles of the nose are the procerus, the orbicularis, the depressor septi, and the levator labii alaeque nasi (►Fig. 1).¹¹ These muscles provide static support for the nose as well as the facial muscles.

There has been some debate on the function of the intrinsic muscles. Nonetheless, intrinsic muscle has an important role in maintaining the nasal airway. The nasal musculature can be generally classified into four groups based on function as shown in ►Table 1.⁸

In addition, the zygomaticus muscle lifts the orbicularis muscle that helps to lower the muscles of the nose.

Supporting Neurovasculature

Blood Supply

The blood supply of the nose consists of the facial artery, which is a branch of the external carotid artery, and the

Fig. 1 Nasal musculature.

ophthalmic artery, which is a branch of the internal carotid artery and the internal maxillary artery (►Fig. 2). They form various vascular arcades in the areas around the nose. The terminal pattern of each branch varies greatly depending on the patient.^{12–14} Nevertheless, many branches have overlapping territory. Hence, an interruption or a significant decrease in blood circulation rarely occurs, even if some of the branches are damaged. Blood is supplied to the midline from the branches on both sides of the nose in the form of dual perfusion. Some people have better perfusion on the left side, whereas others have it on the right side. The phenomenon is closely related to facial asymmetry.¹⁵ The extensive collateral blood supply of the nose makes an open rhinoplasty safe.

Facial Artery

The facial artery travels superiorly to connect with the angular artery. Along the way, caudal to the nose, it gives rise to the superior labial artery. The superior labial artery gives rise to the philtral arteries, which are the main contribution to the ascending columellar artery. The columellar

Table 1 Nasal musculature based on function

Nasal elevators—nose shortening and nostril dilatation
Procerus muscle Levator labii superioris Anomalous nasal muscle
Nasal depressors—nose lengthening and nostril dilatation
Nasalis muscle [transverse portion and alar portion (= dilator naris posterior muscle)] Depressor septi nasi muscle
Minor nasal dilator—dilator naris anterior muscle
Nasal compressor—nose lengthening and nostril narrowing
Nasalis muscle (transverse portion) Compressor narium minor muscle

Fig. 2 Arterial supply of external nose.

artery is transected during the external nasal approach, but this has little effect on the nasal vascularity because of the multiple branches that perfuse the region of the nasal dome.

Ophthalmic Artery

1. The dorsal nasal artery anastomoses with the angular artery in its lateral and downward course through the orbital septum above the medial canthal tendon.¹⁶ Moreover, it forms an axial arterial network supplying an abundant amount of blood to the muscle flap of the nasal dorsum after encountering the supratrochlear artery and infraorbital artery.
2. The external nasal branch of the anterior ethmoidal artery together with the angular artery is mainly responsible for the blood supply of the nasal tip.

Internal Maxillary Artery

The infraorbital artery, which is a branch of the internal maxillary artery, moves to the lateral side of the nose after giving off the external nasal branch.

Venous Drainage

The venous pathway usually parallels with the facial arterial inflow. Moreover, the facial artery is drained to the facial vein having the same name thereof. Generally, it is drained to the cavernous sinus through the ophthalmic vein over the facial vein and pterygoid plexus.

Nerve

The main sensory nerves to the nose are the branches of the ophthalmic nerve and the maxillary nerve, both of which are branches of the trigeminal nerve. The supratrochlear and infratrochlear nerves are branches of the ophthalmic nerve (V1), which conducts innervation on the nasal root, rhinion, and lateral nasal wall. Another branch—the external nasal branch of the anterior ethmoidal nerve—is an important nerve responsible for nasal tip sensation because it exits by passing through a foramen located at a midportion of nasal bone. In particular, the aforementioned nerve moves between nasal bone and the upper lateral cartilage (→Fig. 3).

Fig. 3 Nerve innervation of external nose.

As such, the nerve may be damaged after an intercartilaginous incision, a cartilage-splitting incision, or a subperiosteal dissection. However, sensation is recovered one year after surgery in most cases;¹⁷ complete nasal tip sensory loss is very rare. Also, the infraorbital nerve is a branch of the maxillary nerve (V2), which exits through a foramen in the upper portion of the maxilla. Innervation affects the sensation of the alar base, the upper lip, the lower lateral nasal wall, the nasal vestibule, and so forth.

Bony Vault

The upper third of the nose is a bony vault formed by a pair of nasal bones and the frontal process of the maxilla. It is supported by the bony septum at midline (→Fig. 4). This bony vault is linked to the nasal process of the frontal bone superiorly, the frontal process of maxilla laterally, and the upper lateral cartilage inferiorly. The posterior margin of the frontal process of the maxilla together with the lacrimal bone forms a lacrimal groove. The lacrimal sac is situated in this area. The junction between the caudal area of the nasal bone and the cephalic area of the upper lateral cartilage is referred to as the keystone area. The caudal area of the nasal bone and the cephalic area of the upper lateral cartilage are overlapped by 4 to 5 mm on average. In general, they overlap a shorter distance among Asians compared with Caucasians.¹⁸ The nasal bone length has a certain degree of variation. However, it is 25 mm on average among Caucasians.⁸ For Asians, the nasal bone is often short, small, or thick, and a fracture can occur without excessive manipulation. Thus, it is very important to identify the characteristics of the bony vault of a patient in the preoperative evaluation.

In addition, the pyriform aperture is a structure consisting of nasal and surrounding bone. A crest consisting of the caudal edge of nasal bone on both sides, and the anterior ridge of adjacent maxilla contiguous to the anterior nasal spine creates the pyriform aperture.

Fig. 4 Frontal view of the nose.

Cartilage Vault

Upper Lateral Cartilage

The cephalic side of the cartilaginous vault of the external nose consists of the upper lateral cartilages, one each at right and left side, and the nasal dorsum of nasal septal cartilage (► **Figs. 4 and 5**). Two-thirds of the upper lateral cartilage of the cartilaginous vault and nasal septal cartilage are fused to form one single unit. However, they are separated from each other at the one-third junction of the upper lateral cartilage. Moreover, the point where the nasal bone and cartilage meet is referred to as the rhinion. This area has the thinnest soft tissue on the nasal dorsum. The interval between the lateral edge of the upper lateral cartilage and the edge of pyriform aperture is referred to as the external lateral triangle. The internal aspect is covered with mucosa. The external portion is covered with the transverse portion of the nasalis muscle. Herein, one or more small sesamoid cartilages are placed.

Fig. 5 Lateral view of the nose.

They serve as a bellows in respiration.¹⁹ When the gap between the upper lateral cartilage and the septum becomes greater, each person has a different degree of gap that is widened by the lateral side. The caudal end of the septum is approximately 1 cm longer in the distal rather than the caudal end of the upper lateral cartilage.²⁰ The degree also varies greatly. The ideal angle between the caudal edge of the upper lateral cartilage and the septum is 10 to 15 degrees. In that area is the internal nasal valve ensuring that normal nasal airway is maintained flexibly.²¹

Alar Cartilage (Lower Lateral Cartilage)

Traditionally, the alar cartilage has been classified into two parts: medial crus and lateral crus.²² The two parts are connected by a dome segment. However, Sheen and Sheen²² added the concept of the middle crus to make it easier to understand dissection for tip plasty (Fig. 6). The reason why such classification is important is that complex and diverse shapes of middle crus have a very significant impact on the shape of the nasal lobule. Those cases in which the angle of domal divergence is 60 degrees or smaller are deemed normal. Those cases in which the aforementioned angle is 60 degrees or higher are deemed to have a broad nose. Of those, the cases in which the length of the middle crus dome segment is 4 mm or longer with a curved part and wide domal angle are deemed to have a boxy tip. In contrast, a bulbous tip is defined as follows: The dome segment serving as a meeting point of lateral crus and middle crus is not curved as sharply as a boxy tip; the curved shape is less sharp than the average level; and the widening angle of dome is wide.²³

The medial crus is classified into a footplate and a columella segment. The medial crura on both sides are attached to each other by a small amount of fibroareolar tissue. Between the two-sided medial crura and the two-sided middle crura lies dense fibrous connective tissue in a horizontal direction. Thus, the two-sided medial crura and the two-sided middle crura are firmly attached to each other. The thick part located at the very front of fibrous connective tissue is referred to as the interdomal ligament. The lateral crus is the largest component of the nasal lobule, which performs an important role in defining the shape of the anterosuperior portion of the ala nasi. The lateral crus is in direct contact with the dome segment of the middle crus in intorsion. On the lateral side, it is adjacent to the first cartilage of an accessory cartilage chain that is in contact with the pyriform aperture.⁸ The connection between the caudal edge of the upper lateral cartilage and the cephalic edge of the lateral crus of the alar cartilage is quite unique: The caudal edge of the upper lateral cartilage is curved just like the edge of a scroll toward the outside of the nose as is the edge of the cephalic edge scroll of the lateral crus of the alar cartilage, whose end is curved toward the inside of the nose. Thus, it is overlapped as though the former is hung onto the latter (scroll area). In most patients, these two cartilages are overlapped in this way, thereby improving the function of the internal nasal valve.

Sesamoid cartilages are located at the junction between the upper lateral cartilage and the lateral crus of the alar

Fig. 6 Alar cartilage.

cartilage. It serves as a bearing so that the lateral crus can move smoothly above the upper lateral cartilage. They are connected by dense fibrous connective tissue. This fibrous connective tissue is adjacent to the perichondrium on the surface and the upper lateral cartilage and the alar cartilage lateral crus.²⁴

The accessory cartilage is a chain of several cartilages located in the lateral area rather than the lateral crus of the alar cartilage. They are not only interconnected with each other, but also with the lateral crus through the dense fibroareolar tissue. Hence, these cartilages function as if they are one single cartilage.⁸ Therefore, it is more important to have accessory cartilage than sesamoid cartilage for the shape of the nose. Alar cartilage is shorter among Asian people compared with Caucasian people. It is also weaker among Asian people; its supporting structures are weak. In addition, when the other soft tissues including the skin of that area are thick, the alar cartilage will be even weaker in terms of a supporting structure.¹⁰

Nasal Septum

The nasal septum stands straight up at the midline to support the nasal dorsum. Moreover, it divides the nasal cavity into two spaces. The shape and width of the septum varies among different races. Nonetheless, it is shaped like an “I” when viewed on cross-section. It is shaped like a “T” when the edge of the dorsum of nasal septum is wide.²⁵ The nasal septum consists of one septal cartilage and four bones that consist of the perpendicular plate of ethmoid, vomer, nasal crest of maxilla, and nasal crest of palatine bone (► **Fig. 7**). For convenience sake, the nasal septum is subdivided into the bony septum, the cartilaginous septum, and the membranous septum.

Bony Septum

The perpendicular plate of the ethmoid bone accounts for one-third of the upper part of the bony septum. Where the front side of the inferior edge of the perpendicular plate of ethmoid bone and the upper area of dorsum of nasal septum are joined is referred to as the keystone area.²⁰ This area is located at the cephalic side where the caudal area of nasal bone overlaps with the upper lateral cartilage, approximately

Fig. 7 Nasal septum.

1 cm from the end of the caudal side of nasal bone toward the cephalic side. Moreover, the line, known as the central pillar, where the perpendicular plate of the ethmoid and nasal septum are joined is thick. The protruding part of the premaxilla is the anterior nasal spine (ANS). The ANS is attached to the most prominent caudal part of the septal cartilage edge. Among Asians, the anterior nasal spine is not developed properly; some do not even have an ANS.¹⁰

Cartilage Septum or Septal Cartilage

The so-called quadrangular cartilage supports the dorsum from the rhinion, which is the contact point between the bony vault consisting of bone and the cartilaginous vault, to the upper part of the nose tip. It also forms the shape of the nasal dorsum. Nasal septal cartilage is fused with the premaxilla and vomer located right below it through a tongue-and-groove articulation. This fusion is very important clinically.²⁶ Here, the edge of the nasal septal cartilage is connected to the bony groove of the vomer and premaxilla by fibrous tissue. Thus, the nasal septal cartilage is able to move to a certain extent within the bony groove. As a result, it can be pushed in a lateral direction when the septal cartilage is pressed. Therefore, there is a low risk of fracturing. Moreover, the cartilaginous septum has flexibility. It is possible to manipulate the bony septum by pushing it to the side in case of septoplasty.

The medial margin of the upper lateral cartilage and the dorsum of septal cartilage are directly fused. However, they are connected only by fibrous tissue at one-third of the caudal side.²⁷ The narrow passageway between the caudal edge of upper lateral cartilage and septum is referred to as the internal nasal valve. The apex angle is 15 degrees. As for the internal nasal valve, the caudal edge of the upper lateral cartilage moves toward the septum at the time of inspiration; it moves in the opposite direction at the time of expiration.²⁸ The internal nasal valve movement is definitely required for preventing excessive air inflow too quickly at the time of inspiration. It is normal that the nasal septum is tilted slightly to one side. The cartilage septum is located at the caudal area of the nasal septum, and both sides are covered with mucosa. On each side of the dorsum of the cartilaginous septum is the attached upper lateral cartilage.

Membranous Septum

The membranous septum links the caudal edge of the nasal septal cartilage to the cephalic edge of the alar cartilage's medial crus. Thus, a pair of depressor septi nasi muscles passes through it. It is imperative to dissect the membranous septum at a point close to the cartilaginous septum's caudal edge.

Conclusions

Each race has a different nose shape. Caucasians usually have a narrow nose (leptorrhine), whereas African Americans have a flat nose (platyrrhine). Asians have intermediate features somewhere between these two races (mesorrhine). The following are anatomical considerations in the performance of an Asian rhinoplasty.

1. The nasal dorsum is wide, low, and flat.
2. The nose tip is low, wide, and rounded (bulbous tip): This is because the alar cartilage is small and both sides are separated from the nose tip.
3. The skin of the nose tip and supratip area has a thick dermis and a subcutaneous layer. Also, it has an abundance of fibrofatty tissues. Moreover, sebaceous glands are highly developed.
4. The nasolabial angle looks narrow when viewed from the side. Also, the ala is huge and bent caudally. The columella is relatively short, whereas the columella base is recessed cephalically.
5. The nostril is splayed out horizontally when viewed from caudal side. Thus, the distance between alar base on both sides is far.
6. The anterior nasal spine is hypoplastic.
7. The alar cartilage is small and weak, making it difficult to project the nasal tip with alar cartilage suturing alone. Furthermore, it is also impossible for the alar cartilage to sustain the tip with the rhinoplasty approach that is conducted commonly among Caucasians.
8. Nasal septal cartilage is very thin. Thus, it cannot be routinely utilized as an autogenous cartilage structural support graft.²⁹

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