

Quantitative Measurements of the Bulbous Tip in Ethnic Rhinoplasty

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Background: Refinement of the bulbous nasal tip continues to be one of the more challenging aspects of ethnic rhinoplasty. Better objective measures are necessary to quantitatively assess changes in surgery of the bulbous tip. We propose the use of a new nasal anatomic landmark in the subnasal vertex view, designated c^1 , in conjunction with previously described landmarks to offer an improved means of characterizing the bulbous tip. Together, these landmarks form a pentagon, allowing for measurement of its angles and distances to quantitatively evaluate the nasal tip in the subnasal vertex view. We hypothesize that this method will provide a means of demonstrating a decrease in tip bulbosity postoperatively.

Methods: An institutional review board–approved retrospective analysis of 44 nonwhite patients undergoing ethnic rhinoplasty was undertaken and preoperative and postoperative photographs in the subnasal vertex view were subjected to the proposed analysis. All patients underwent an open approach rhinoplasty with a combination of tip defatting and cartilage graft placement. Using the polygonal construct, several angles, distances, and areal indices were measured from the preoperative and postoperative photographs and comparison was made for statistical significance.

Results: All but 1 of the 8 parameters examined demonstrated statistical significance comparing preoperative and postoperative values. These measures, thus, allow the surgeon to objectively assess and ascertain a reduction in tip bulbosity of postoperative ethnic rhinoplasty patients.

Conclusions: This article presents a new anatomic landmark c^1 seen from a subnasal view of the tip. This landmark can be combined with previously established landmarks to create a polygon that allows for a simple yet objective method for measuring the reduction and contouring of the ethnic bulbous tip.

Key Words: rhinoplasty, ethnic rhinoplasty, bulbous tip, nasal anatomy

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Throughout history, rhinoplasty has been an aesthetic procedure that was largely targeted toward the white population. With increasing immigration and the rising socioeconomic status of other ethnic populations, rhinoplasty has greatly expanded to include non-white ethnicities.¹ Refinement of the bulbous tip continues to be one of the more challenging aspects of ethnic rhinoplasty. This is not only because of the complexity of the surgical techniques but also due to the interplay between achieving aesthetic appearance and facial balance while trying to maintain the ethnically defining features of the patient.² Previous studies have established the morphological differences between non-white noses and that of the white nose.^{1–6} Of these differences, diminished nasal bones and cartilage, along with a prominent fibrofatty subcutaneous tissue pad are common in the ethnic nose.⁷ The bulbous tip, a

common tip of nonwhite populations who seek rhinoplasty, has been described as depressed and flattened with hypertrophy of both the nasal skin covering and its underlying cartilaginous framework.⁸ Several well-defined anatomic characteristics of the bulbous nasal tip include: a wide interdomal distance, a thick, sebaceous epidermal-dermal layer, an interdomal fibrofatty tissue, weak and thin lower lateral cartilages, and a weak tip support of the caudal septal attachments and intracanal ligaments. The basic repair of the bulbous tip works to rectify the stated problems. Corrections that are made during rhinoplasty are thinning of the nasal tip fat, strengthening of the lateral cartilage, and placing a strut tip graft. This allows for a more refined, sculpted, aquiline nasal tip, which is what most nonwhite rhinoplasty patients desire.

In 1986, Farkas et al³ described, in detail, nasal anatomic landmarks (Fig. 1A). In the subnasal vertex view, they described the landmarks of the soft nose. One landmark of particular importance was a horizontal line at the upper limit of the columella (c), which they defined as the base of the nasal tip. They also defined the pronasale (prn) as the most protruded point of the tip of the nose, which is located in the midaxis of the apex nasi. In combination with these landmarks of the soft nose, a new anatomical landmark c^1 , is defined in this paper. c^1 is the most lateral extent of the dome of the lower lateral cartilages, as seen from the submental vertex view. The combination of the base of the nasal tip c , c^1 , and prn, forms a pentagon that defines the area of the tip lobule in the subnasal vertex view (Fig. 1B). Angles of the pentagon can be measured, preoperatively and postoperatively, to see changes in the nasal tip width. In addition, measurements can be taken of the nasal area and from the subnasale (sn) to pronasale (prn) to assess changes in nasal tip dimensions.

In this study, preoperative and postoperative subnasal vertex views were used to measure angles and distances to show decrease in tip bulbosity of nonwhite rhinoplasty patients. The goal was to create a method that can be used to objectively establish a decrease in tip bulbosity of postoperative nonwhite rhinoplasty patients.

METHODS

This study was approved by the institutional review board of the New York Eye and Ear Infirmary of Mount Sinai. Forty-four preoperative and postoperative subnasal views were studied to determine reduction in the size of bulbous tips. Areal nasal indices, as described by Farkas et al³ (Fig. 1A), were measured preoperatively and postoperatively, including nasal tip protrusion and the columella nose width index (Table 1). In addition, a new anatomic landmark is described c^1 . A pentagonal area (Fig. 1B), using the alar base, c^1 , and prn was constructed, and angular changes were measured preoperatively and postoperatively (Fig. 3A–C). The following measurements were also taken from each patient to measure the change in nasal tip measurements: columella width (Fig. 2A), the base of the pentagon to the tip (Fig. 2B), the alar to alar distance (Fig. 2C), and the base of the columella (sn) to the tip (prn) (Fig. 2D).

All measurements were made using a computer measuring software device (Iconico.com), which measures geometric shapes on a computer screen. SPSS statistical methods were used to calculate P values for the changes in angles and tip projection (Fig. 3A–C).

All patients had open rhinoplasty septal strut and shield grafting and intradomal/subcutaneous fat excision. Each patient had a combination

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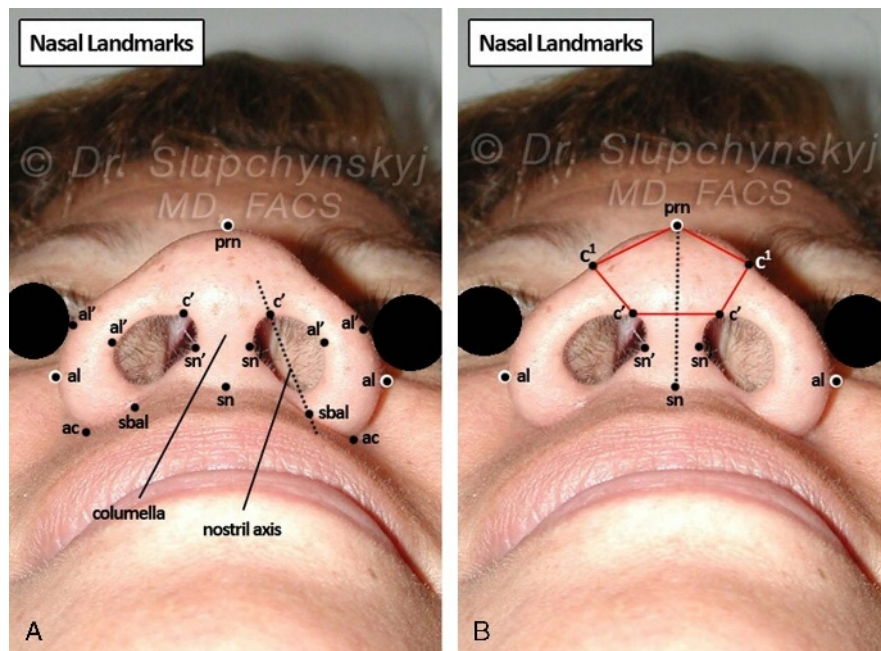


FIGURE 1. Nasal landmarks. A, Nasal landmarks as defined by Farkas et al.⁵ The columella is labeled above as the central portion between the nostrils. The nostril axis goes through the sbal to its most anterior portion, c'. The prn is defined as the most protruded portion of the nasal tip. Sn is defined as the base of the columella and al is defined as the most lateral portion of the alar wings. B, Using the previous landmarks defined by Farkas et al, a new landmark, c¹, is defined. Combined with c' and prn, a pentagon can be made. Measurements can be taken from the pentagon to ensure preoperative and postoperative esthetic results.

of lower lateral cartilage manipulation, which included, dome division, cephalic strip, domal, and intradomal suturing.

RESULTS

Comparing the preoperative and postoperative measurements of the 2 soft nose areal indices, 3 angular measurements, and 3 nasal measurements among each patient, only 1 measurement failed to show statistical significance. Concerning the areal indices, both the nasal tip protrusion-width index ($P = 8.1 \times 10^{-18}$) and the columella nose width index ($P = 5.9 \times 10^{-9}$) showed significant change postoperatively (see Table 2, Supplemental Digital Content 1, <http://links.lww.com/SAP/A198>). Of the 3 angular measurements taken, changes in the left mid angle ($P = 1.6 \times 10^{-13}$) and the left base angle ($P = 1.3 \times 10^{-12}$) were statistically significant. The peak angle measurement, however, was not statistically significant ($P = 0.0637$) (see Table 3, Supplemental Digital Content 2, <http://links.lww.com/SAP/A198>). The 3 nasal measurements recorded were: the base of the pentagon to peak ($P = 9.6 \times 10^{-7}$), the bottom of the columella to the peak ($P = 8 \times 10^{-15}$), and the al to al measurement (4.49×10^{-10}). Of these, all were statistically significant (see Table 4, Supplemental Digital Content 3, <http://links.lww.com/SAP/A198>, with the last column showing the ratio of the columellar width, sn' to sn', preoperatively and postoperatively).

DISCUSSION

The literature includes several articles that outline nasal anatomic landmarks for objective assessment.^{1–3,5,8} In a morphometric study, Farkas et al⁴ described 7 different nostril types using a combination of measurements including the nasal alar width, tip projection, columellar width, and columellar length. They also used the modified Topinard system to measure the inclination of the longitudinal axis of the nostril from the horizontal, which is the most accurate way to classify nostrils. In doing this, they were able to show objective

differences in nostril widths between different ethnic groups. Their results showed that type 2 nostrils were most common in whites, type 3 were most common in Asians, and type 6 were most common in African Americans. They also observed, when comparing the nose width to the nasal tip protrusion in the type 6 nostrils, the ratio increased. This means that the soft nose became larger in relation to the protrusion, equating to a more bulbous nose. The authors of this article stated, “for an aesthetic appearance, a well-balanced relationship between nasal protrusion and columellar length is very important.” However, the term “well balanced” is not clearly defined and this may be based on personal preference.

It has been well established that a new standard needs to be created for assessing ethnic differences in the pre and post-operative phase for ethnic rhinoplasty. Porter and Olson⁶ acknowledged that despite the significant differences between the ethnic nose and the white nose, ethnic noses are still being compared with the white norm. They created an objective method to analyze the African American female nose using proportional relationships of the anthropometric measurements in their subject population. Their results showed that the African American nose differed in the following average relationships: a decreased columellar to lobule ratio, alar width to intercanthal distance greater than 1:1, a more acute nasolabial angle, and a nasal tip projection that was at the upper limit of the white norm due to the increased nasal length

TABLE 1. Soft Nose Indices and Corresponding Equations

Soft Nose Indices	Equations
Nasal tip protrusion-width index	$sn-prn \times 100/al-al$
Columella-nose width index	$sn'-sn' \times 100/al-al$

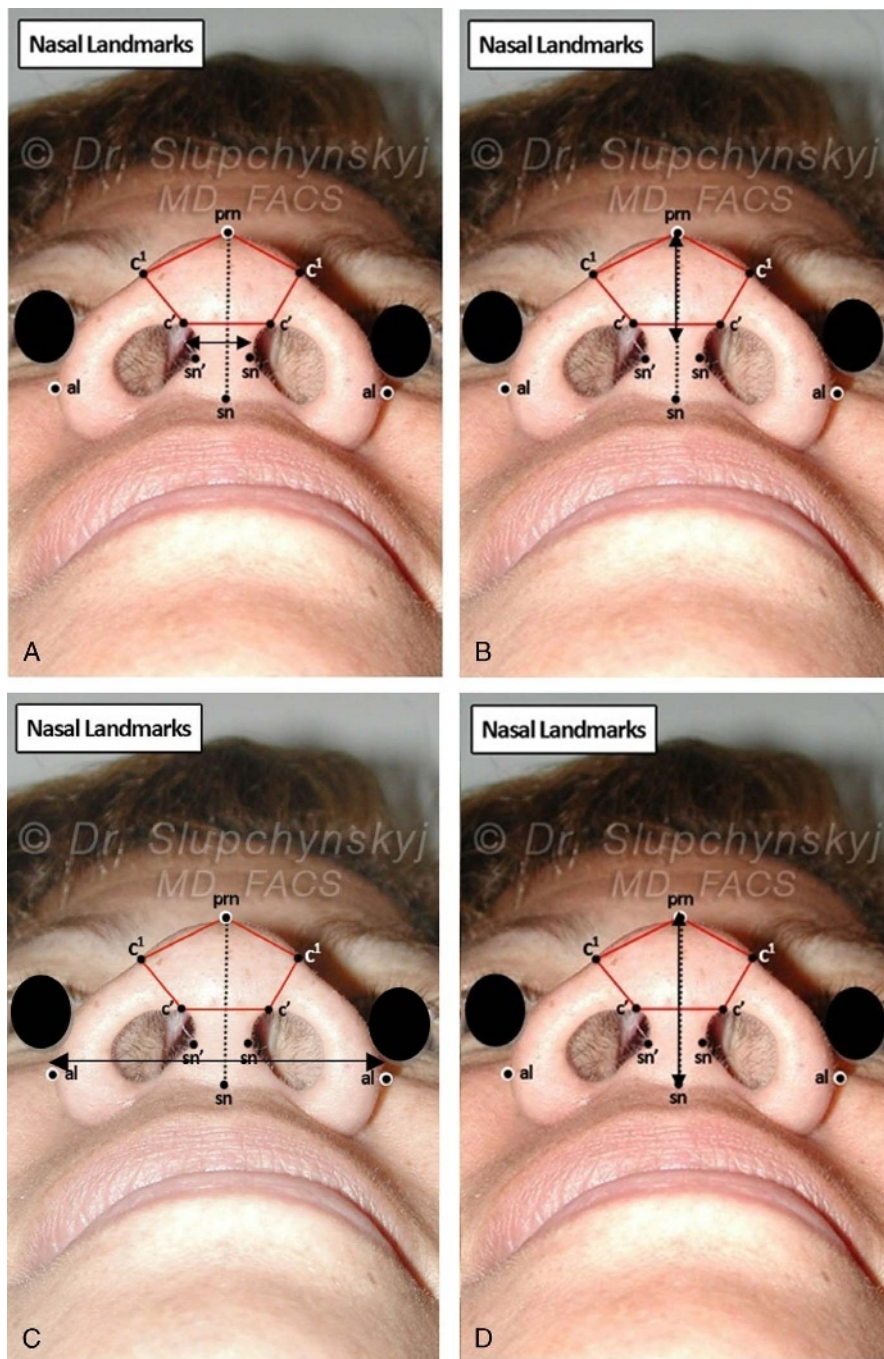


FIGURE 2. Preoperative and postoperative measurements taken of the bulbous tip. A, Columellar width from sn' to sn'. B, Base of the pentagon to the most protruded point, pm. C, Nasal width from alar to alar. D, Base of the columella, sn, to the most protruded point, pm.

relative to tip projection in the white population. They also went on to challenge Farkas et al, stating that the African American patient does not commonly fit into any of the 7 nostril types they described. Porter and Olson⁶ categorized African American patients into 3 different nostril types: inverted, vertical, and horizontal. Most of their subjects fell into the vertical subcategory. As with most of the other studies that have been done trying to create an objective method, Porter and Olson⁶ found significant variability within their subject population. They have

attributed this variability to the different ethnic origins of the African American population in the United States.

Other studies have tried to categorize and objectify the Hispanic nose. Higuera et al⁵ conducted a 10-year retrospective study and classified the Hispanic patient into 3 different archetypes. This group of research also described surgeries that work well to correct these archetypes. Archetype 3, of particular importance, described the bulbous nose in Hispanic patients. It was characterized by decreased nasal

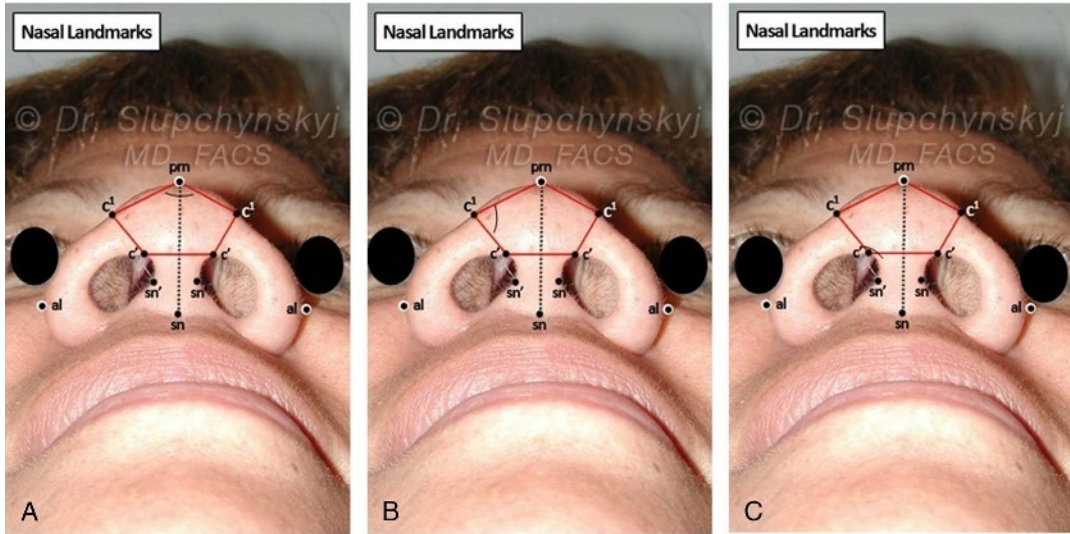


FIGURE 3. Angular measurements of the pentagon. Preoperative and postoperative angular measurement of the pentagon can be taken to ensure aesthetic results. A, Peak angle measurement. B, Left mid angle measurement. C, Left base angle measurement.

length with a broad nasal base with thick skin and a bulbous, underprojected tip. Archetype 3 patients have a large disproportion between the upper and lower third of the nose. The lower third is commonly wider than the shorter upper third. In this archetype, the proper

surgical correction is rhinoplasty to correct the dorsum-base disproportion while using techniques, such as columellar struts, tip grafts, and dorsal augmentation. Columellar strut grafts are especially useful for structural support in this population because of the weakened medial crura present in these patients. Higuera et al stressed the importance of surgeons to become familiar with the Hispanic nasal anatomy by stating “Hispanics are projected to become the largest minority population within the next 10 years, and rhinoplasty in this population will become more frequent over time. It behooves plastic surgeons to become familiar with the different archetypes of Hispanic noses and appropriate corrective techniques for each.”

Considering the difficulty of nasal tip surgeries in nonwhite patients, it is essential to correctly identify the nasal tip pathology. For good aesthetic results, it is necessary for surgeons to understand components of the nasal tip and how they effect nasal tip projection. The

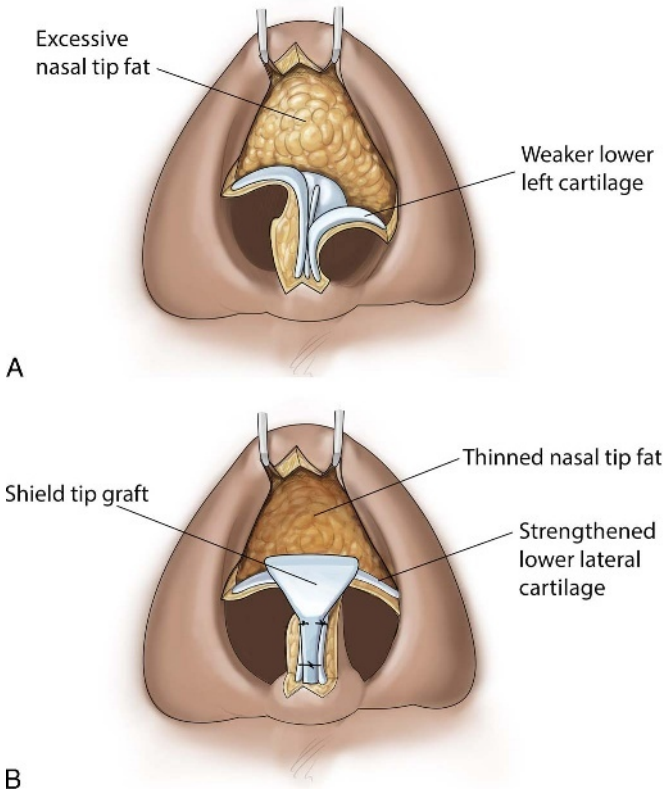


FIGURE 4. Bulbous tip defect and repair. A, This figure displays the two main characteristics of the bulbous tip, excessive nasal tip fat and weak lower lateral cartilage. B, The repair of the bulbous tip consists of thinning the nasal tip fat, strengthening the lower lateral cartilage, and placing a shield tip graft.

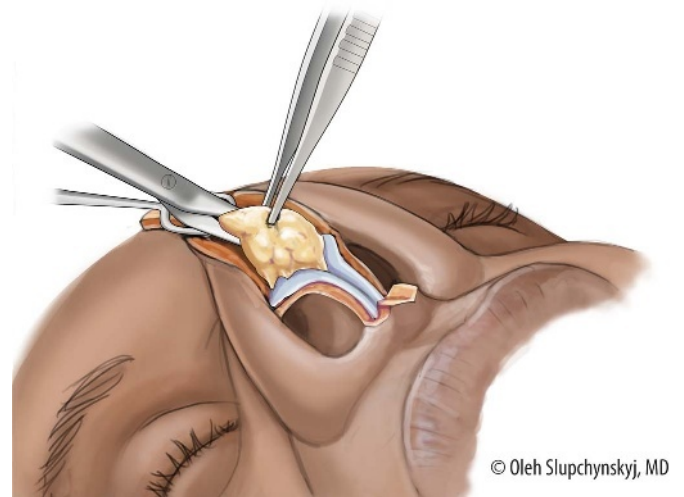


FIGURE 5. Animation of an open approach rhinoplasty of the bulbous nose. This animation is an example of how an open approach rhinoplasty is done. There is greater visualization of the interdomal fat pad which makes it easier to remove.



FIGURE 6. Intraoperative and postoperative images of an open approach rhinoplasty removal of the interdomal fat pad.

following components that effect projection, and therefore must be considered, are the skin, subcutaneous tissue, superficial musculoaponeurotic system, ligaments, and the lower lateral cartilage.⁹ An important anatomic feature, which has effects on nasal tip projection, is the interdomal fat pad (Fig. 4). The interdomal fat pad is more commonly present in patients with thick-skinned noses, and a prominent feature of bulbous noses (Figs. 5 and 6).^{9,10} To correct this, an open technique is of greater benefit, because it increases the ease of thinning the nasal tip fat (Fig 7). Another important feature of correcting the nasal tip projection is strengthening the lower lateral cartilage and putting a shield tip graft in to make a more defined tip.⁹

In our study, an objective, quantitative method was designed to show significant contouring and reduction of the ethnic bulbous tip. This method was created by using an open approach rhinoplasty and

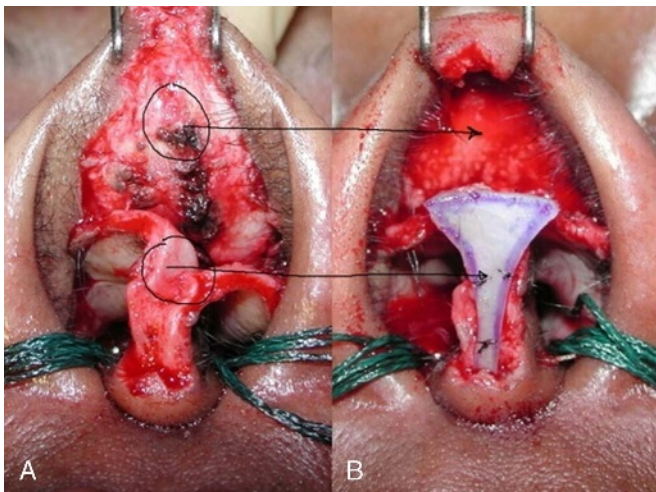


FIGURE 7. Intraoperative photos of an open rhinoplasty technique on a bulbous nose. A, The photo shows an open technique on a bulbous nose before the thinning of the excessive fat (top circle) in the soft nose and the strengthening of the lower lateral cartilage (bottom circle). B, This photo shows the results after the thinning of the excessive fat in the soft nose and the strengthening of the lower lateral cartilage.

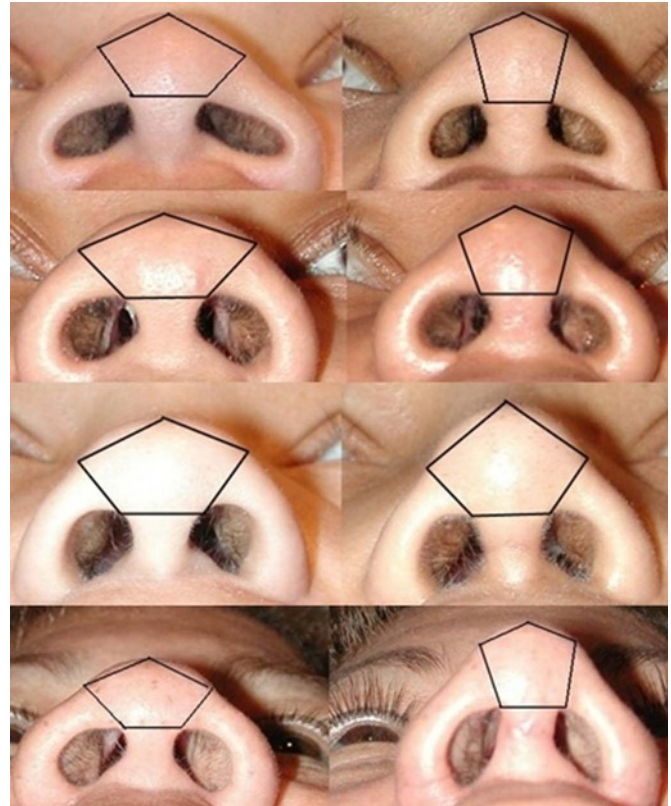


FIGURE 8. Before and after photos of patients with bulbous noses who underwent open rhinoplasty.

a combination of tip defatting and cartilage graft placement (Fig. 7B). A new anatomical landmark was created, c^1 . This was combined with previously defined anatomical landmarks, c' and prn , as described by Farkas et al³ to create a polygon. Using the distances between the anatomical landmarks of this polygon and the angles of the same polygon, it is possible to create a reduction of ethnic bulbous tip with statistical significance in size reduction, polygonal elevation and recontouring of the tip (Fig. 8). Although the achievement of a statistically significant reduction in tip bulbosity does not necessarily signify aesthetic success, the author's surgical methods demonstrate how this polygonal construct may be applied to objectively ascertain a decrease in tip bulbosity of postoperative ethnic rhinoplasty patients. The full photos for 3 representative patients undergoing surgical correction of a bulbous tip are shown in Figure 9.

The causes of the wide nasal tip are, an enlarged lateral crura, wide arching between the medial and lateral crura, thick skin, an enlarged interdomal distance, or a combination of these.^{10,11} An enlarged interdomal distance is caused by angle of divergence of the intermediate crura.¹¹ During surgical procedures of the bulbous nose, it is necessary to treat the alar cartilage and also the fatty tissue found over the dome, and the lateral crurae need to be altered.¹² It has been shown that many surgeons still use tip maneuvers that can work well for thin-skinned whites, but are not adequate for thick epidermal, dermal, and subdermal ethnic tips. To that note, it is essential to distinguish 2 different types of bulbous tips: thick-skinned (primarily ethnic) and thin-skinned (primarily white).

For slightly bulbous or thin-skinned noses, a closed approach may be sufficient.¹³ Thin-skinned bulbous tips are primarily bulbous because of overdeveloped lower lateral cartilages. For these individuals, nasal tip maneuvers, such as dome division, cephalic strip, interdomal



FIGURE 9. A, Preoperative and 3-year postoperative photos of 35-year-old woman who underwent an open rhinoplasty approach, defatting of the supratip fat, dome division, septal cartilage strut graft, shield graft, custom carved dorsal silastic implant, and horizontal nasal sill narrowing. B, Preoperative and 4-year postoperative photos of 54-year old woman who underwent an open rhinoplasty approach, defatting of the supratip fat, dome division, septal cartilage strut graft, shield graft, custom carved dorsal silastic implant, osteotomies, and horizontal nasal sill narrowing. C, Preoperative and 4-year postoperative photos of a 36-year old woman who underwent an open rhinoplasty approach with defatting of the supratip fat, dome division, septal cartilage strut graft, shield graft, custom carved dorsal silastic implant, osteotomies, and horizontal nasal sill narrowing.

suturing, as well as other well-established techniques, are adequate for nasal tip contouring. However, to achieve adequate aesthetic results for the thick-skinned and/or fatty subcutaneous bulbous tips, traditional nasal tip techniques are not adequate and will not be evident through the thick epidermal-dermal-subdermal layer.

In addition, performing rhinoplasty through a closed technique for thin-skinned bulbous tips may be adequate, but is not appropriate for the thick-skinned bulbous tip. The open approach allows for greater exposure, but requires the surgeons to have a thorough understanding of the underlying anatomy.⁹ If the surgeon does, it enables a surgeon to correctly identify the pathology of the underlying framework. The decreased visualization in the closed approach causes increasing complexity of the surgery and makes defatting the intradomal and subdermal fat virtually impossible (Fig. 7). It is known that the open technique has its limitations, such as causing a greater amount of edema to the nasal tip and also the production of the transcolumellar scar. These limitations equate to a longer duration to achieve aesthetic results.⁵ If careful surgical technique is used during the open procedures, a surgeon can minimize the limitations of it. Furthermore, placement of shield, strut, and plumper grafts in the tip are easier through an open approach.

CONCLUSIONS

In conclusion, ethnic rhinoplasty comprises a significant portion of all rhinoplasty procedures. It is necessary for surgeons to understand the differences between the white and nonwhite nose, especially in regard to management of the bulbous tip. This article presents a new anatomic landmark *c*¹ seen from a subnasal view of the tip. The landmarks can be combined with previously established landmarks to create ob-

jective method of measuring the reduction and contouring of ethnic bulbous tip.

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