

Evidence-based Nasal Analysis for Rhinoplasty: The 10-7-5 Method

Íris M. Brito, MD*†
Yash Avashia, MD*
Rod J. Rohrich, MD*

Summary: Rhinoplasty is one of the top 5 aesthetic surgical procedures performed in plastic surgery. A methodical evaluation based on solid and up-to-date scientific evidence in different key areas of nasal and facial analysis is presented, the 10-7-5 method. This represents the most important preoperative step for a successful rhinoplasty. The 10-7-5 method for nasal analysis is a useful instrument that provides the rhinoplasty surgeon a deep comprehension of nasal anatomy. Understanding the nasal structures' main relationships and consequences of each surgical maneuver on nasal framework assists on establishing the appropriate surgical goals for each patient, both in primary and secondary rhinoplasty cases. This systematic analysis of patient's frontal, lateral, and basal nasal views provides a background to identify changes to ideal aesthetic proportions and how to surgically restore them while maintaining gender and ethnic congruency. (*Plast Reconstr Surg Glob Open* 2020;8:e2632; doi: 10.1097/GOX.0000000000002632; Published online 26 February 2020.)

INTRODUCTION

Rhinoplasty is still one of the top 5 aesthetic surgeries performed, ranking third in 2018 with over 213,000 procedures performed.¹ A comprehensive preoperative clinical analysis, including evaluation of nasofacial proportions and systematic nasal analysis, is the most important initial step for a successful rhinoplasty.^{2,3} A methodical evaluation based on solid and up-to-date scientific evidence in different key areas of nasal analysis is presented—the 10-7-5 method (Table 1). The senior author (R.J.R.) has extensively used this method both for primary and secondary rhinoplasty case analysis. It allows either the experienced or young surgeon to precisely appraise facial balance and nasal proportions and establish the correct surgical goals to each patient. An aesthetic pleasing result can only be achieved if patient's nasal features and primary areas of concern are managed in a customized approach. A systematic evaluation of patient's frontal (Fig. 1), lateral (Fig. 2), and basal (Fig. 3) nasal views provides a background to identify changes to ideal proportions and how to surgically restore it maintaining gender and ethnic congruency (Video 1) (see Video, [online], which displays the 10-7-5 method for clinical nasal analysis).

From the *Dallas Plastic Surgery Institute and private practice, Dallas, Tex.; and †Department of Plastic Surgery and Burns Unit, Coimbra University Hospital Center, Coimbra, Portugal.

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FRONTAL VIEW (10 KEY AREAS)

Facial Proportions

Several definitions of aesthetic ideals, relationships, ratios, and angles, have been described in detail including sex, ethnic, and age-specific characteristics.²⁻⁶ Analysis of facial skeletal morphology and cephalometric headplates by Ricketts,⁴ life-size photography and soft-tissue response to skeletal alterations in rhinoplasty by Guyuron,^{5,6} and nasofacial ratios and relations by Rohrich et al^{2,7} provided golden proportions for bone and skin components to define accurately rhinoplasty aesthetic goals. It is also helpful to detect facial disharmonies that can influence the surgical outcome. Adjunctive procedures addressing the facial skeleton such as orthognathic surgery, and careful attention to skin thickness, are important features to consider in rhinoplasty and facial balance.^{2,4-7} Evaluation of the patient should include static and dynamic views, to identify possible dynamic changes of the nose and upper lip while smiling.^{2,3,7} Examples of application of nasofacial analysis are the facial golden proportions (3 similar distances: trichion-to-eye, nose-to-chin, and eye-to-mouth)⁴ and

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Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

Table 1. Evidence-based Nasal Analysis: The 10-7-5 Method

| Nasal View | Analysis |
|--------------------------------------|--|
| Frontal | |
| 1. Facial proportions | Height (thirds), width (fifths), symmetry |
| 2. Skin type/quality | Fitzpatrick type, thin or thick, sebaceous |
| 3. Symmetry/nasal deviation | Midline, dorsal deviation, C-, reverse C-, or S-shaped deviation |
| 4. Dorsal aesthetic lines | Straight, symmetric or asymmetric, well or illdefined, narrow or wide |
| 5. Bony vault | Narrow or wide, asymmetric, short or long nasal bones |
| 6. Midvault | Narrow or wide, collapse, inverted-V, saddle deformity |
| 7. Nasal tip | Ideal/bulbous/boxy/pinched, supratip, tip-defining points, infratip lobule |
| 8. Alar rims | Gull-shaped, facets, notching, retraction |
| 9. Alar base | Width |
| 10. Upper lip | Long or short, dynamic depressor septi, upper lip crease |
| Lateral | |
| 1. Nasofrontal angle and radix | Acute or obtuse, high or low radix, prominent or low nasion |
| 2. Nasal length, dorsum and supratip | Length: long or short; Dorsum: smooth, hump, scooped out; Supratip: break, fullness, pollybeak |
| 3. Tip projection | Over or underprojected |
| 4. Tip rotation | Over or underrotated |
| 5. Alar-columellar relationship | Hanging or retracted ala, hanging or retracted columella |
| 6. Periapical hypoplasia | Maxillary or soft-tissue deficiency |
| 7. Lip-chin relationship | Normal, over or underprojected chin |
| Basal | |
| 1. Nasal projection | Over or underprojected, well or illdefined tip-defining points, columellar-to-lobule ratio |
| 2. Nostril | Symmetry, long/narrow or short/wide nostril, nostril-tip ratio, concave or convex ala |
| 3. Columella | Caudal septal deviation, flaring of medial crura |
| 4. Alar base | Width |
| 5. Alar flaring | |

ratios (equivalent horizontal thirds: hairline-to-brows, brows-to-nasal base, and nasal base-to-menton; vertical fifths: limits adjacent to the most lateral projection of the head, the lateral canthi, and the medial canthi).⁷

Skin Type/Quality

The rhinoplasty surgeon should recognize the diverse anatomical variations that define ideal aesthetics across cultures or ethnic backgrounds.⁸ White patients (Fitzpatrick type 1-3) are characterized by thin skin and facial proportions with equally spaced vertical fifths and horizontal thirds (Fig. 4).⁸ African noses commonly have thicker sebaceous skin; wider vertical middle fifth, and shorter height of the horizontal middle third.⁸ Asian

patients typically have relatively thick skin; wider middle fifth distance, and upper and middle thirds larger than the lower third.⁸

Skin thickness can be a major factor affecting rhinoplasty outcomes.^{2,9,10} Thin skin may show reconstructed nasal frame imperfections; however, nasal shape definition is more easily achieved.^{2,9,10} A thicker skin can camouflage minor imperfections, but reduces the surface contour definition, due to prolonged edema and inflammation that can lead to scarring and unfavorable aesthetics.^{2,9,10} Nasal skin is thickest at the radix and nasal tip and thinner at the rhinion and columella.^{9,10} Thick skin at the tip and columella was associated with poorer rhinoplasty outcomes.¹⁰

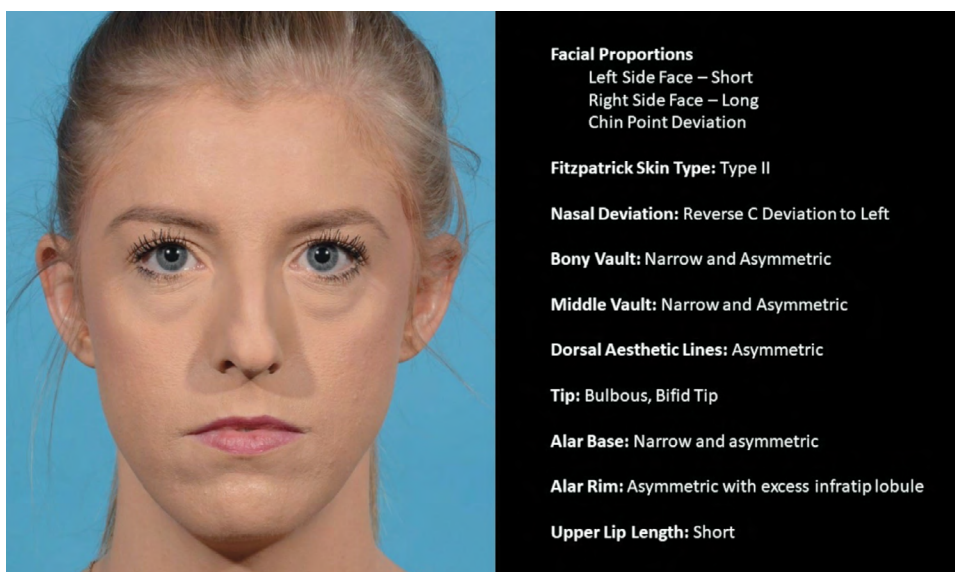


Fig. 1. Clinical nasal analysis: Frontal view analysis of a 25-year-old patient before primary rhinoplasty and chin augmentation (10 key areas).

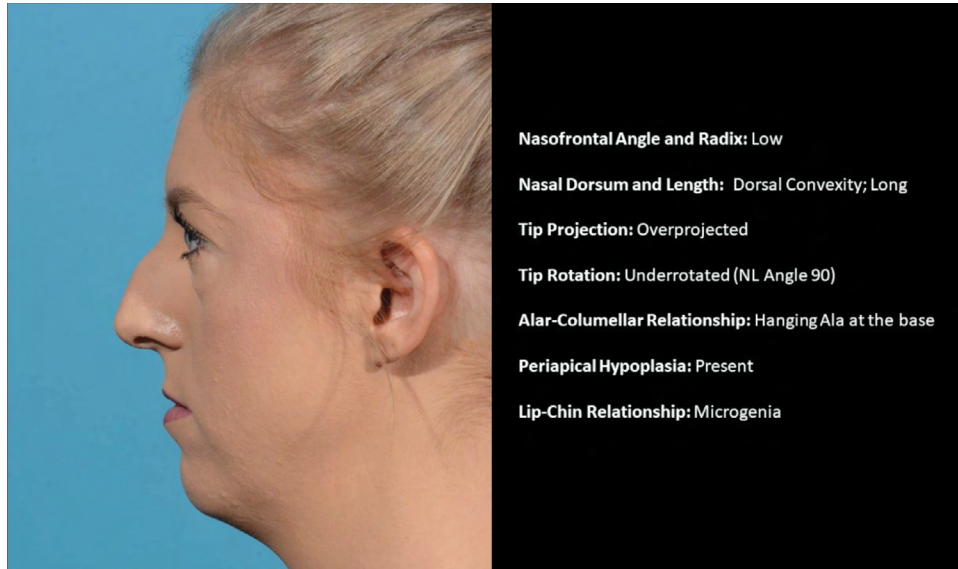


Fig. 2. Lateral view analysis (7 key areas).

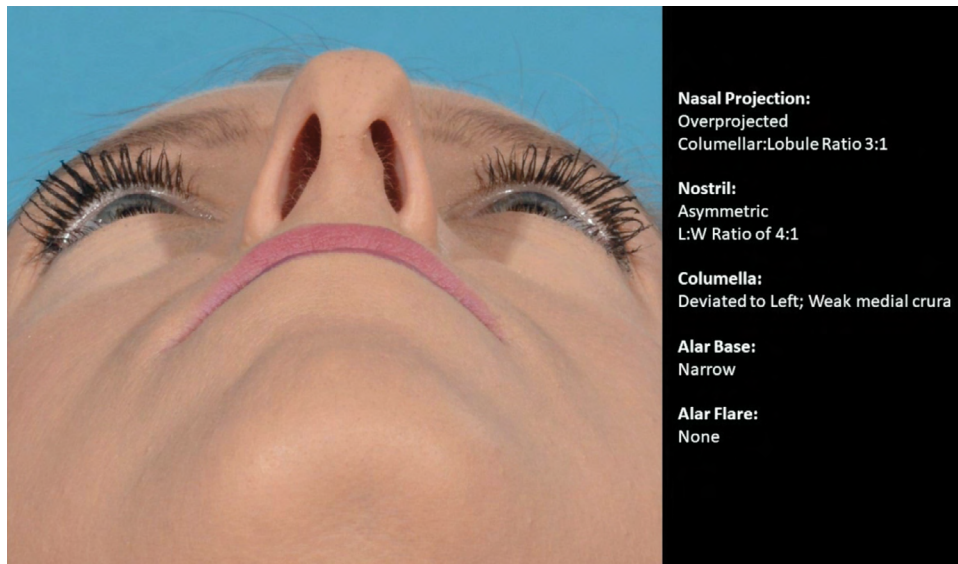


Fig. 3. Basal view analysis (5 key areas).

Symmetry and Nasal Deviation

Nasal deviation is commonly associated with facial asymmetries (nose tends to deviate away from face wider side).¹¹ Correction of a deviated nose on an asymmetric face aim to obtain nasal symmetry and center the nose on a line between the mid glabella and the mid cupid's bow.¹¹ The deviated nose is an osseocartilaginous unit in which all components may play a role, and both functional and aesthetic problems must be addressed.^{12,13} Different classification systems exist for nasal deviation.^{12,13} Rohrich et al¹² described 3 basic types: caudal septal deviations (septal tilt, C-shaped and S-shaped), concave dorsal deformities (C-shaped, reverse C-shaped), and concave/convex dorsal deformities (S-shaped with bony pyramid deviation).¹³ Guyuron et al reported 6 types of septal deviations: septal tilt (40%), C-shape anteroposterior (32%), C-shape

cephalocaudal (4%), S-shape anteroposterior (9%), S-shape cephalocaudal (1%), and localized deviation or spurs (14%).¹⁴ Correction may require diverse steps: open approach with wide exposure and release of septum deforming forces, straightening the septum and maintaining an adequate dorsal and caudal strut, restoring long-term support, reducing the hypertrophied turbinates, and adequate osteotomies.^{12,13} Cartilage scoring and spreader grafts were also recommended.¹⁴

Dorsal Aesthetic Lines

Dorsal aesthetic lines were defined as originating on the supraorbital ridges, traversing medially along the glabellar area, converging at the medial canthal ligaments, diverging at the keystone area, and ending at the nasal tip.¹⁵⁻¹⁷ Symmetry, width and definition should be accessed

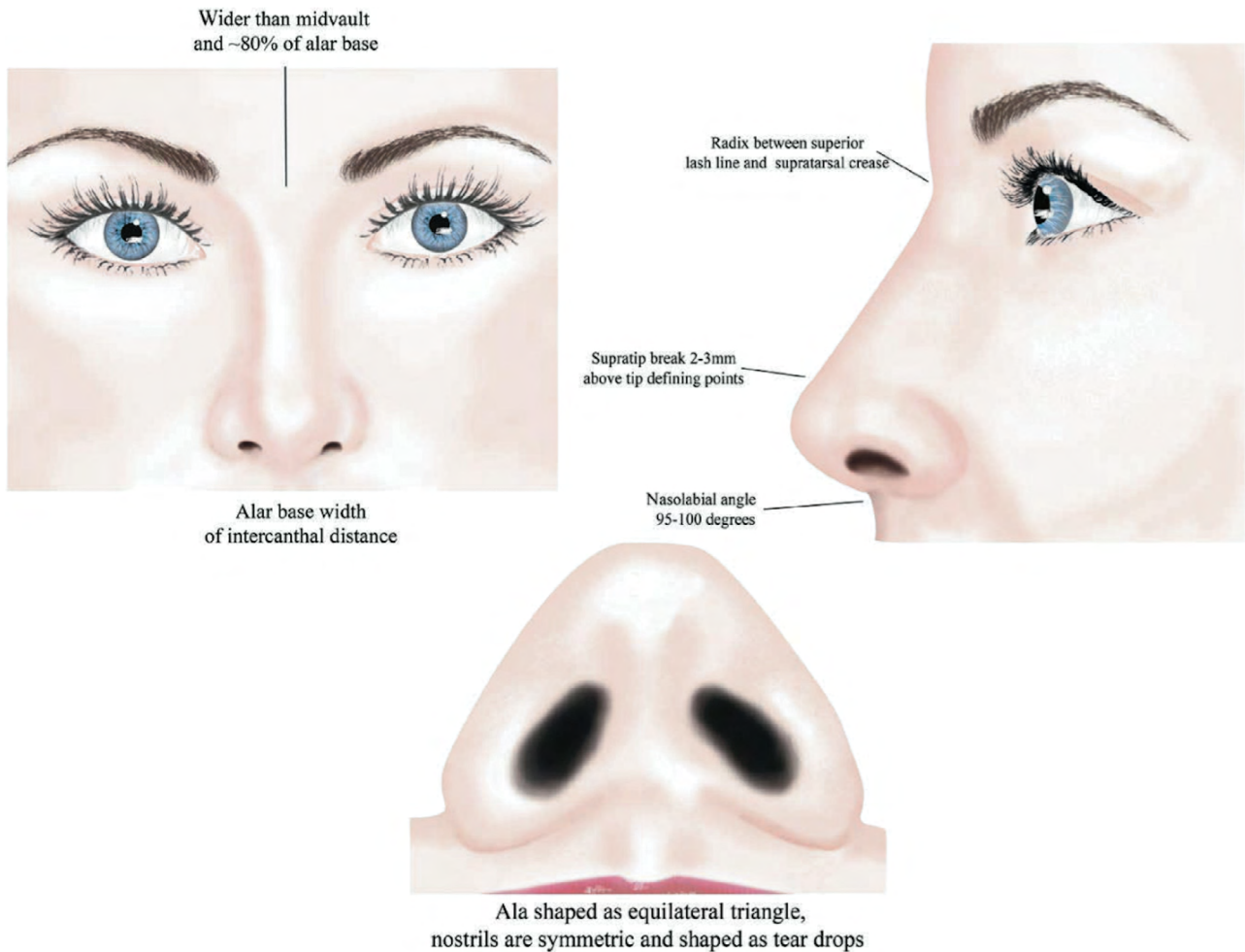


Fig. 4. Caucasian nose. Adapted with permission from *Plast Reconstr Surg* 2019;143:1179e–1188e.

in every patient. Dorsal aesthetic lines width should match either the interphiltral distance or the tip-defining points width.¹⁵ Male dorsum is wider and straighter, with less concavity at the superciliary ridges compared with women.¹⁷ Component dorsal hump reduction is a reproducible 5-step technique to restore aesthetic and functional distortions of the dorsum: 1) separation of upper lateral cartilages from the septum, 2) incremental septal reduction, 3) dorsal bony reduction/rasping, 4) verification by palpation, and 5) final modifications (spreader grafts, suturing techniques, osteotomies).^{15,16,18}

Bony Vault

The bony vault is composed of 3 distinct structures, the paired nasal bones and the perpendicular plate of the ethmoid.¹⁹ Bony vault width, symmetry, and length of nasal bones are analyzed in frontal view. Bony base width should be 70%–80% of the alar base, typically equal to the intercanthal distance.^{15,17} An open roof deformity (wide and flat bony vault) and width discrepancy between the bony vault and cartilaginous midvault may result from dorsal bony hump reduction.¹⁹ Osteotomies are indicated to narrow wide bony vaults, close open-roof deformities and create symmetry by straightening deviated nasal bones.^{15,17,19–21}

External percutaneous lateral osteotomies provide a controlled fracture pattern with less intranasal trauma while minimizing associated morbidities of bleeding, edema, and ecchymosis.^{15,20,21}

Midvault

The cartilaginous midvault include the paired upper lateral cartilages and the cartilaginous septum.^{19,22} The keystone area represents a triangular region, union of the 6 distinct anatomical structures between the bony vault and the cartilaginous midvault.^{19,22} Midvault width and deformities like the inverted-V or saddle-nose are identified in frontal view. The inverted-V deformity derives from midvault collapse due to over-resection of upper lateral cartilages (compared with the septum), creating a discrepancy between the bony and cartilaginous vaults that unmasks the caudal outline of the nasal bones.^{15,19} Equalization of keystone width can be achieved by narrowing the bony vault (osteotomies), widening the midvault (tension spanning sutures, spreader grafts or autospreader flaps), or a combination of both.^{19,22,23} Autospreader flaps adjust the height of upper lateral cartilages in a precise manner while preserving internal valve function.²⁴ In saddle deformity, a deficit in nasal dorsal support secondary to the

loss of septal cartilage and/or nasal bone height exists.^{25,26} Different reconstructive options were reported.^{25,26}

Nasal Tip

The normal tip configuration (triangular and well-defined) should be distinguished from the bulbous tip (rounded and ill-defined) and the boxy tip (square and wide).²⁷ Anatomically, the nasal tip has an angle of divergence of 30 degrees, the domal arc a width of 4 mm or less, and a distance between the tip-defining points of 5–6 mm.²⁷ It can be broad and less defined in men. The boxy tip may result of an increased angle of divergence (>30 degrees), a widened domal arc (>4 mm), or a combination of the 2.²⁷ Excess infratip lobule projection (normal nostril apices coincide with the infratip lobule midpoint) is often the result of deformities of the middle crus and lower lateral cartilage.²⁸ The excess classification is divided into intrinsic (ie, long middle crus, wide middle crus, lower lateral malposition, and combinations) and extrinsic causes (ie, prominent septum).²⁸ A pinched tip with overprojected infratip lobule may result from an abnormal rotational orientation of the lateral crus with the caudal edge below the cranial edge.²⁸ Different management algorithms were proposed to treat these conditions.^{27,28}

Alar Rims

The alar rim's ideal shape resembles a gull in flight.⁸ Alar rim deformities, such as retraction, notching, collapse, and asymmetry, are common problems in rhinoplasty patients.²⁹ Excessive elevation of the alar rim is considered alar retraction, and a sharp angle within the ovular lateral contour is alar notching, which can extend cephalically and is sometimes referred to as a parenthesis deformity or ball tip.²⁹ Alar collapse is defined by a loss of support along the anterior portion of the alar rim resulting in a concavity, and it may be static, dynamic, or both.²⁹ Alar contour grafts have become an ideal method for controlling alar shape and improve aesthetic outcomes.²⁹

Alar Base

Alar base width ideally approximates the intercanthal distance, one-fifth of the face width, or 70% of nasal height.^{30,31} Alar base surgery is performed to address excessive width of the nasal base, alar flaring, large nostril size, and alar base or nostril asymmetries.^{3,30} Each issue may require different techniques.^{30,31} It should be performed at the conclusion of rhinoplasty since alar flare changes with alterations in tip projection.^{30,31} If the tip is deprojected, flaring will increase; if projection is increased, flaring will decrease.³¹

Upper Lip

Ideal upper lip position is considered 1–2 mm of gingival show on maximum smile (slightly less in males).³² Excessive incisor show is considered a “gummy smile” whereas a “long lip” may cause an inadequate incisor show.³² Upper lip length should be assessed as well as the dynamic effects of depressor septi nasi. This paired muscle originates at the orbicularis oris and/or maxilla, and inserts on the medial crura, caudal septum, and

dermocartilaginous ligament.^{32–34} A hyperactive depressor septi muscle is associated with a deformity during animation (particularly with smiling) characterized by a drooping nasal tip, shortened upper lip, and a transverse crease in the midphiltral area.³³ Resection and release/transposition techniques were proposed to correct this deformity and enhance the tip-lip relationship.^{33,34}

LATERAL VIEW (7 KEY AREAS)

Nasofrontal Angle

Two lines tangent to the glabella and to the nasal dorsum, intersecting at nasion, define the nasofrontal angle.^{15,35} The degree of nasofrontal angle, vertical position of the radix, and horizontal location of nasion are important profile measures. The nasofrontal angle (radix) should lie between the superior lash line and the supratarsal crease, with the nasion ~15 mm anterior to the medial canthus.^{8,15,36} The ideal nasofrontal angle varies by gender, with 130 degrees considered acceptable in White men versus 134 degrees in women.^{15,35} Ethnic variability exists as well.^{8,15,35} Optimal female noses present a horizontally and vertically lower nasion with concave to straight profile, while optimal male noses have a higher nasion and straight profile.³⁶

Nasal Length, Dorsum, and Supratip

The ideal nasal length (nasofrontal angle to the tip-defining points) is equivalent to two-thirds of midfacial height, the stiomion-to-menton distance, or to chin vertical.^{7,8,37,38} The perceived nasal length and projection can be influenced by the position of the nasofrontal angle.¹⁵ The nose will appear more elongated (with less tip projection) if the angle position is more superior and anterior, versus shorter (more projecting tip) if the angle is more inferior and posterior.¹⁵ Techniques for shortening or lengthening the nose were reported.^{22,37,39}

The nasal dorsum should be smooth, with a slight supratip break in women roughly 2–3 mm above the tip-defining points.⁸ In male patients, the dorsum should follow a line drawn from the radix to the tip-defining points, while in women, it should be along a parallel line ~2 mm more posterior.^{7,15} This evaluation will indicate if dorsum reduction or augmentation is needed.⁷ Any dorsal hump and its location should be noted (strictly osseous, osseocartilaginous, or cartilaginous only).¹⁵ Dorsal over-resection of these components will result in a scooped out deformity on nasal profile. The anterior septal angle defines the gateway to safely approach the dorsum,⁴⁰ and performing the dorsal reduction or augmentation maneuvers required for each patient.^{15,41,42}

Balance between the nasal dorsum and the tip-defining points determine the supratip break.⁴³ A supratip break is accomplished through creating tip-defining points with good projection and reducing the dorsum to the desired effect. The pollybeak (or supratip) deformity is defined as excessive supratip fullness.^{44,45} The most important predisposing factor for pollybeak deformity development after primary rhinoplasty is heavy thick skin.⁴⁵ Other structural

factors may contribute to this deformity, whereas supratip sutures and/or skin excision techniques can be employed to prevent it.^{44,45}

Tip Projection

Projection is considered ideal when 50%–60% of the tip lies anterior to a vertical line adjacent to the upper lip or represents 0.67 times the ideal nasal length.^{8,38,43,46} The tip can be over or under-projected if it stands above or below to these values. Specific surgical procedures were recommended to control, decrease or increase tip projection.^{38,46,47}

Tip Rotation

Tip rotation is determined by the nasolabial angle and should equal ~90 to 95 degrees in men and 95 to 100–110 degrees in women.^{7,8} The intersection of a line drawn through the nostril aperture midpoint and other perpendicular to the Frankfort horizontal plane, defines the nasolabial angle.^{7,48} Fullness at the columellar-labial angle (curved junction of the columella with upper lip) caused by a prominent caudal septum creates a pseudoro-tation appearance.⁷ Rotation of nasal tip can be achieved by means of several methods, mainly addressing the lower lateral cartilages or caudal septum.^{3,48,49}

Alar-columellar Relationship

The ideal alar-columellar relationship is 2–3 mm of columellar show in the lateral view.⁵⁰ Excess columellar show is associated with a hanging columella or a retracted ala.^{50,51} The distance from the long axis of the nostril to either the alar rim or the columella roll should be 1–2 mm.^{50,51} A longer distance to the superior half of the nostril is suggestive of alar retraction, whereas a decreased distance suggests a hanging ala.⁵⁰ Similarly, a longer distance to the inferior half suggests a hanging columella and a decreased distance represents columellar retraction.⁵⁰ Correction can be achieved by cephalocaudal repositioning of the ala, columella, or both.^{50,51}

Periapical Hypoplasia

Volume deficiency in the central midface impacts nasal aesthetics.⁵² A skeletal (maxillary) or soft tissue deficiency may produce periapical hypoplasia. Augmentation of the pyriform aperture can decrease the apparent size of the nose, increase the nasal tip and base projection, and widen the nasolabial angle.⁵² This and other adjunctive procedures such as orthognathic surgery or malar augmentation may be considered along with rhinoplasty.⁷ Furthermore, rhinoplasty can be a useful adjunct to restore the ideal nasomaxillofacial relationship following skeletal changes after orthognathic surgery.⁵³

Lip-chin Relationship

Chin projecting surface should lie approximately at (preferred in men) or up to 3 mm posterior (in women) to a vertical line drawn from the half-distance point of the ideal nasal length and tangential to the upper lip vermilion anteriormost point.^{54,55} Most rhinoplasty patients with chin disharmony have inadequate chin projection, either

alone or in combination with inadequate chin vertical dimension.^{54,56} A small chin may enlarge the apparent size of the nose and vice versa.^{43,55,56}

BASAL VIEW (5 KEY AREAS)

Nasal Projection

On basal view, the nose should create an equilateral triangle with a columella-to-lobule ratio of 2:1.^{7,8,57} Nasal tip refinement, using both suture modification of existing cartilage and soft cartilage grafts instead of rigid visible grafts, has been recommended for correction of poorly defined tip-defining points and nasal over or under-projection.⁵⁷

Nostril

The nostrils should be symmetric and have a teardrop shape with a long axis extending from the base to apex.^{7,8} The ideal nostril-tip relationship should be ~2:1.⁴³ A relationship imbalance can result in a long and narrow nostril, or inversely in a short and wide one. In ideal basal view, the alar rims fall within an equilateral triangle.^{29,58} A concave ala may result in alar collapse or a pinched tip secondary to weak lateral crura, which is often a consequence of inappropriate interruption or excessive resection of the lower lateral cartilage, improper tip graft placement extending laterally to existing dome, or a transdomal suture too tight.^{29,58} A convex ala is usually caused by an excessive convexity of the lower lateral cartilage or alar thickness.⁵⁸

Columella

The ideal columella requires a smooth concave shape bridging the nasal tip and nasolabial junction.⁵⁹ Columella primary (intrinsic) deformities originate from malpositioned medial crura or excessive soft tissue.⁵⁹ Most commonly, a widened or asymmetric columella results from premature or excessive medial crura flaring.⁵⁹ Secondary deformities are often the result of caudal septum deviation, pushing the medial crura and soft tissue into the nostril.⁵⁹

Alar Base and Alar Flaring

Proper assessment of nasal base width requires a clear distinction between the width of the alar base and the degree of alar flare. Ideal nasal width approximates the intercanthal distance (normal, 31–33 mm).^{31,60} Alar flare is defined as the greatest width of the ala, which convexity should not exceed 2–3 mm lateral to the alar-facial crease.^{30,31} Three types of alar flare were described.^{3,31} Flare was classified according to where the most lateral point along the alar rim occurs relative to the level of the sill-base junction on basal view (below, at, or above this level).³¹ Alar base wedge excision is designed to address alar flare only.^{3,31} Correction of other horizontal alar base disharmonies may require wedge excision of the nostril sill, narrowing the base laterally, reduction of the alar base thickness, or a combination of these techniques.⁶⁰

CONCLUSIONS

The shape and anatomical position of the nose are major determinants of overall facial harmony and aesthetics.¹¹

Outcomes in rhinoplasty are based on comprehensive nasal analysis, mastery of nasal anatomy, and understanding the consequences of each surgical maneuver.²⁸ A systematic approach to evaluating nasal structures and their relationship to one another will help to achieve facial balance after rhinoplasty.² The 10-7-5 method for nasal analysis, linking and comprising different areas of expertise in rhinoplasty, is a useful instrument to provide the surgeon a deep comprehension of each anatomical configuration and to design the appropriate surgical plan in an individual basis. This should determine the operative maneuvers required to address every problem, recognizing the impact of each correction in other areas of nasal structure, to obtain the ideal aesthetic proportions in frontal, lateral, and basal views.

Rod J. Rohrich, MD

Dallas Plastic Surgery Institute and Private Practice
9101 N Central Expy
Dallas, TX 75231
E-mail: rod.rohrich@dpsi.org

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