Accepted Manuscript

Nasofacial angle and nasal prominence: A quantitative investigation of idealized and normative values

Dr Farhad B. Naini, BDS MSc PhD, Consultant Orthodontist/Honorary Senior Lecturer, Martyn T. Cobourne, BDS MSc PhD, Professor of Orthodontics and Craniofacial Development, Umberto Garagiola, DDS PhD, Professor of Orthodontics, Fraser McDonald, BDS MSc PhD, Professor and Head of Orthodontics, David Wertheim, MA PhD CEng, Professor

Nasofacial angle and nasal prominence: A quantitative investigation of idealized and normative values

[1] Farhad B. Naini, BDS, MSc, PhD

[2] Martyn T. Cobourne, BDS, MSc, PhD

[3] Umberto Garagiola, DDS, PhD

[4] Fraser McDonald, BDS, MSc, PhD

[5] David Wertheim, MA, PhD, CEng

Author affiliations:

[1] Consultant Orthodontist/Honorary Senior Lecturer, Kingston and St George's Hospitals and St George's Medical School, London, United Kingdom

[2] Professor of Orthodontics and Craniofacial Development, King's College London Dental Institute, London, United Kingdom

3 Professor of Orthodontics, Department of Reconstructive and Diagnostic Surgical Sciences, University of Milan, Milan, Italy

[4] Professor and Head of Orthodontics, King's College London Dental Institute, London, United Kingdom

[5] Professor, Faculty of Science, Engineering and Computing, Kingston University, London, United Kingdom

Ethical approval: **National Research Ethics Service; NRES (UK); REC reference:**

06/Q0806/46

Corresponding author:

Dr Farhad B. Naini

Consultant Orthodontist

St George's Hospital & Medical School

Blackshaw Road

London, UK, SW17 0QT

Email: Farhad.Naini@yahoo.co.uk

Tel: +44 20 8725 1251

Fax: +44 20 8725 3081

Summary

Purpose: A quantitative evaluation of the influence of the nasofacial angle on perceived attractiveness and threshold values of desire for rhinoplasty.

Material and Methods: The nasofacial angle of an idealized silhouette male Caucasian/white profile image was altered incrementally between 21° and 48°. Images were rated on a Likert scale by pretreatment patients (n = 75), laypersons (n = 75), and clinicians (n = 35).

Results: A nasofacial angle of approximately 30° was deemed to be ideal, with a range of 27° to 36° deemed acceptable. Angles above or below this range were perceived as unattractive. Angles outside the range of 21° to 42° were deemed very unattractive. Excessive nasal prominence (nasofrontal angle of 48°) was deemed the least attractive. In terms of threshold values of desire for surgery, for all groups a threshold value of ≥39° and ≤24° indicated a preference for surgery, with clinicians least likely to suggest surgery. The patient group assessments demonstrated the greatest variability, stressing the importance of using patients as observers, as well as laypersons and clinicians, in facial attractiveness research.

Conclusions: It is recommended that in rhinoplasty planning, the range of normal variability of the nasofrontal angle, in terms of observer acceptance, is taken into account, as well as threshold values of desire for surgery.

Keywords: nasofacial angle, nasal tip prominence, rhinoplasty, profile aesthetics

INTRODUCTION

Nasal prominence is often the most dominating parameter of the facial profile, and an observer's visual perception is often drawn to this important facial promontory (*Pitak-Arnnop.,* 2011). The nasofacial angle, also termed the frontal facial angle, is a potentially important factor in the perception of facial profile attractiveness (*Pearson* and *Adamson*, 2004). It is the inner angle formed by the intersection of the facial plane (glabella to pogonion) and the nasal dorsal plane (nasion to pronasale) (Figure 1) (*Naini*, 2011).

The concept of perception in relation to facial attractiveness has been investigated (*Springer et al.,* 2012). A total of 324 subjects completed an "adjective mood scale" and rated a number of statements regarding their own appearance, emphasising the potential impact on social functioning and willingness to undergo aesthetic surgery. Photographs of these subjects were also assessed by 50 independent judges. It was found that impaired well-being was associated with impaired facial self-perception, independent of attractiveness. Willingness to undergo aesthetic surgery appeared not to be affected by the individual's sense of well-being and, very importantly, in subjects with impaired well-being who undergo aesthetic surgery, facial self-perception appeared unlikely to be improved. An interesting subsequent investigation by *Springer et al*. (2012) assessed the relationship between facial self-perception and perception by others. Their results demonstrated that individuals perceive their own facial attractiveness to be greater than that expressed in the opinions of others. These results are consequential, and the authors maintained the importance that self-identification and self-confidence play in an individual's psychosocial status.

An investigation by Springer et al. (2008) assessed the potential implications for rhinoplasty in relation to nasal morphology, particularly in relation to gender specificity, which is paramount in relation to rhinoplasty planning. Their results demonstrated that optimal female

noses had a horizontally and vertically lower nasion position and were concave to straight in profile, whereas optimal male noses had a vertically and horizontally higher nasion position and a straight profile. Also, women and men with a straight or concave profile were significantly more satisfied with the appearance of their nose than those with nasal dorsal humps. Gender-related differences in nasal shape appear to be subtle, with nasion position being one of the main factors. A nasal hump and a supratip break were found to be undesirable. Springer et al. (2009) subsequently analysed the influence of an observer's gender in relation to nasal aesthetics and morphology. Their results demonstrated that, generally speaking, female judges accorded significantly higher ratings of attractiveness as compared to male judges independent of the gender of observed images, with this difference being magnified when assessing the most unattractive male images, although this was not apparent when assessing "optimal" female and "optimal" male noses. However, women displayed the same preferences for "optimal" and "average" noses as compared to the "most unpleasant" noses. In assessing their own noses, women were significantly less satisfied with their appearance in general as compared to men. In comparison to men, women were more critical in assessing the appearance of their own nose as opposed to the noses of other people. Roxbury et al. (2012) assessed the impact of nasal asymmetry on observer perceptions of facial asymmetry and attractiveness and the ability of rhinoplasty to minimize it. They found that faces displaying nasal asymmetry were rated as less symmetrical overall and that straightening rhinoplasty diminished overall facial asymmetry, with decreasing nasal asymmetry leading to significant improvements in facial attractiveness. It has also been observed that the visual impact of symmetry on the perception of attractiveness increases significantly when approaching the midline (*Springer et al*., 2007), and the nose is the major midline structure of the face.

The principal aim of this investigation was to evaluate quantitatively the influence of nasal prominence, as represented by the nasofacial angle, on perceived attractiveness. The relationship between the nasofacial angle and attractiveness was recorded to ascertain the range of normal variability, in terms of observer acceptance, and to determine the clinically significant threshold value or cut-off point beyond which the angle is perceived as unattractive and surgical correction is desired. The perceptions of patients, clinicians, and laypersons were compared for these different variables.

MATERIAL AND METHODS

Subjects and procedures

Ethical approval was granted for the study by the National Research Ethics Service; NRES (UK) (REC reference: 06/Q0806/46).

Two-dimensional profile silhouettes are used routinely to assess the perceptions of facial attractiveness (*Ioi et al.,* 2005; *Naini et al*., 2012). A profile silhouette image was created with computer software (Adobe[®] Photoshop[®] CS2 software). The image was manipulated using the same software to construct an "ideal" profile image with proportions,[3] and linear and angular soft tissue measurements (*Farkas et al.,* 1986; *Farkas and Kolar*, 1987; *Farkas*, 1994; *Naini*, 2011), based on currently accepted criteria for an idealized Caucasian/white male profile, as previously described (*Naini et al*., 2012).

The nasofrontal angle of the idealized image (image BL: 30°) was altered in 3° increments from 21° to 48°, to represent variations in the angle, ranging from excessive to reduced nasal prominence (Figure 2).

Based on the results of a pilot study and power calculation, 185 observers took part in the study, separated into three groups (pretreatment orthognathic patients, laypersons, and clinicians; Table 1), with the following selection criteria:

● Patients: pretreatment (only 1 consultation appointment); primary concern was facial appearance; no previous facial surgical treatment; no history of facial trauma; no severe psychological issues.

● Laypersons: no previous facial surgery, deformities, or history of facial trauma.

● Clinicians: involved in the management of patients with facial deformities; included 19 maxillofacial surgeons (all with experience in facial aesthetic and reconstructive surgery) and 16 orthodontists, with 1–16 years of experience in the clinical management of patients requiring orthognathic and facial reconstructive surgery. No plastic surgeons were used as observers, although in clinical practice any surgeon appropriately trained in surgery of the nose may undertake nasal aesthetic assessment.

Each observer was given a questionnaire and asked to provide the following information: age, gender, ethnic origin (white or nonwhite), how would you rate the attractiveness of your facial appearance, and how important do you think it is to have an attractive facial appearance. An instruction sheet accompanied the questionnaire, asking the observers to rate each image in terms of facial attractiveness using the following rating scale:

1. Extremely unattractive.

2. Very unattractive.

3. Slightly unattractive.

4. Neither attractive nor unattractive.

5. Slightly attractive.

6. Very attractive.

7. Extremely attractive.

Observers were also asked whether they would consider surgery to correct the appearance if this was their facial appearance (yes or no).

The images were placed in random order into the software application Microsoft PowerPoint® (Microsoft Corporation, Redmondd, WA, USA). Each image was identified by a randomly assigned double letter in the top right corner of the screen (e.g. BL, GQ etc.; Figure 3). A duplicate image assessed intra-examiner reliability (images DN and EM). Each observer sat undisturbed in the same room in front of the same computer and 17-inch flat-screen monitor. The presentation and the images were created in such a way that each of the profile silhouette images, when viewed on the monitor, had the same dimensions as a normal human head, based on an average lower facial height, reducing the potential effect of image size on observer perception. Each observer examined the images in the PowerPoint® presentation by pressing the "Page Down" button on the keyboard, in their own time. The Likert-type rating scale used is largely accepted in the psychology literature as the most useful rating method (*Langlois et al.*, 2000). The seven-point Likert scale described above was used by each observer to rate each image in terms of attractiveness.

Statistical analysis

The median and interquartile observer ratings were calculated for each angle and for each observer group; these descriptive statistics were calculated using software that we developed using MATLAB (MathWorks Inc, Natick, MA, USA). Additionally, data were modelled by curve fitting performed using MATLAB. Similarly, the software calculated the proportions in each group suggesting a desire for surgery. Additional paired t-tests were performed using Minitab version 16 (Minitab Inc, State College, PA, USA) following application of the Ryan–

6

Joiner test in Minitab used to examine whether data were consistent with a normal

distribution.

RESULTS

Reliability analysis

Table 2 shows the first and third quartile rankings of the Likert score. The results indicate

that there was generally good agreement in the three observer groups. The interquartile range

for all three groups was 1.

Perceived attractiveness of images

In Table 3, the median attractiveness rating of the observers on a Likert scale from 1 to 7 is

shown, where 1 indicates 'extremely unattractive' and 7 indicates 'extremely attractive'. A

nasofacial angle outside the range of 27° to 36° was associated with a reduction in the median

attractiveness scores in all three groups of observers. The lay and patient groups have the

same median attractiveness score for the identical images (DN and EM), again indicating

good repeatability.

Most attractive and least attractive images

Table 4 demonstrates the data in rank order from most to least attractive, sorted on the basis

of responses from the clinician group then the lay group. Tables 5 and 6 demonstrate the

proportion expressed as a percentage of each observer group suggesting that surgery is

required. The results indicate that clinicians were generally least likely to suggest surgery for

varying degrees of nasofacial angle. Images DN and EM were identical, and so repeatability

of the 35 clinicians' assessment was excellent, in both cases 20% suggesting surgery. For the

75 laypersons, the assessment of the two repeated images was also similar (17% and 23%),

which was also seen in the group of 75 patients (39% and 41%). For many of the images, there was generally good agreement among clinicians and laypersons as to whether surgery was required. There was more variability in the assessment for the patient group as indicated by fewer very low (<25%) and very high (>75%) percentages of the groups suggesting surgery. Taking 50% of each observer group as a cut-off where half of the individuals suggested surgery, for all three groups the threshold value of desire for surgery was ≥39° and ≤24°.

For observers who considered attractiveness to be important (>2), Table 7 indicates the proportion suggesting surgery. For patients 68 of 75, for laypersons 71 of 75, and all clinicians considered attractiveness to be important. Thus nasofacial angle deviations of ≥39° and ≤24° were again associated with a higher proportion of individuals desiring surgery.

For those who did not consider attractiveness to be important (7 patients and 4 laypersons), Table 8 summarises the proportion desiring surgery; the table has no column for clinicians, as all considered attractiveness to be important. Clearly the lay observer number is low in this category.

DISCUSSION

Planning aesthetic rhinoplasty requires the determination and validation of correct nasofacial morphological relationships, which requires two sources of information (*Naini et al.,* 2008). Age-, gender-, and ethnicity-specific population averages based on anthropometric data allow comparison of a patient's nasofacial measurements and proportions to the population norms. No longitudinal data are available for the nasofacial angle, but there are some cross-sectional data available (*Farkas*, 1994). Additionally, the perceived attractiveness of the proportions

and morphological relationships should be confirmed by the judgement of patients and the lay public, and ideally compared to the judgement of treating clinicians. This was the main purpose of this investigation.

The results of this investigation demonstrated that increasing the nasofacial angle deviation in either direction from an angle of 30° (Image BL) was associated with a reduction in the median attractiveness scores in all three groups of observers. The highest attractiveness scores were for image BL (30°), closely followed by image CL (33°) and image KJ (27°). An angle of 36° (images EM and DN) was deemed to be neither attractive nor unattractive, i.e., essentially acceptable even if not attractive. However, from nasofacial angles of ≤24° and ≥39°, the images were viewed as unattractive by all observer groups. The farther the angle was reduced to less than 24°, the more unattractive it was perceived to be, with ≤21° being perceived as very and extremely unattractive by all observer groups. Additionally, the further the angle increased above 39°, the more unattractive it was perceived to be, with 42° and above being perceived as very or extremely unattractive by all observer groups. Angles outside these ranges are perceived as unattractive by all groups, with greater deviations leading to progressively reduced perceptions of attractiveness.

In terms of desire for surgical correction, the results indicate that clinicians were generally the least likely to suggest surgery for varying degrees of nasofacial angle. Although there was generally good agreement in the three observer groups, there appears to be a high degree of agreement amongst clinicians, and the reason for this may be the potentially higher critical capabilities of clinicians resulting from their training. This stresses the importance of using patients as observers in facial attractiveness research.

As with other facial parameters, it is generally acknowledged that the nasofacial angle has a range of normal individual variability. As a starting point, for comparative purposes and by

way of contrast, it is useful to look at the nasofacial angle in idealized images from classical and Renaissance art and sculpture (Table 9). The first known treatise on ideal human proportions was written by the Greek sculptor Polycleitos of Argos. Unfortunately, no copies of this book exist. However, it is known, based on evidence from the physician Galen, that Polycleitos based his most important statue, the Doryphorus, on his treatise. The nasofacial angle in these statues is approximately 25° to 30°. From a number of idealized male and female profile images painted in the Renaissance, the nasofacial angle is again within the range of 25° to 30°. Two images were 20° and 35°, respectively, although this appeared to be due to differences in the sagittal position of the chin rather than nasal prominence (Table 9). A common denominator in the morphology of the nasal dorsum in these images is that it is relatively straight in all the images.

In ancient Greek sculpture, the reduced values for the nasofacial angle may be related to the classical "Greek nose" type, in which the nasal radix is higher. The nasal radix region, and the nasal starting point, are important parameters in nasal aesthetic evaluation and rhinoplasty planning. For the purposes of this investigation, the nasal starting point was not altered in any of the images, specifically for the purpose of altering only the one parameter being investigated, namely, nasal prominence. However, it should be borne in mind that differences in the nasal radix morphology must be taken into account in planning surgery.

Additionally, a number of modern surgical authorities have provided "ideal" values for the nasofacial angle, based on anecdotal evidence and the "good eye" of the respective surgeon. For example, in their 'aesthetic triangle', Powell and Humphreys (1984) described an ideal range of 30° to 40°, and suggested that the higher values were male and the lower were better suited to female profiles. They demonstrated both the female and male "ideal" profiles with a nasofacial angle of 36°. Papel and Capone (2004) corroborated the values provided by Powell and Humphreys (1984). Lehocky (2006) provided the ideal values as 36° in men and 34° in

women, based on anecdotal opinion. Sheen (1978) and Rees (1980) stressed the importance of nasal tip prominence in achieving a pleasing facial contour, without providing any specific ranges for the angle. They stressed the importance of nasal projection in relation to the face without the imposition of an "ideal" nose onto every facial profile; however, they conceded that certain nasofacial relationships are essential for an optimal aesthetic result, with well-defined nasal relationships forming the basis of accurate diagnosis and planning.

One of the pioneers of modern rhinoplasty, Jacques Joseph (1865–1934), referred to the nasofacial angle as the 'profile angle'. He measured this angle in paintings by celebrated artists, including Leonardo da Vinci and Thomas Gainsborough, and determined an ideal angle of 30°, with a range of 23° to 37° (*Naini*, 2011).

Farkas anthropometrically measured the 'inclination of the nasal bridge' in relation to 'the vertical', which, although not directly defined, appears to be quite similar to the nasofacial angle, except that the vertical glabella-to-pogonion line is substituted for a vertical line parallel to the Frankfort plane (*Farkas et al.,* 1986; *Farkas*, 1994). Average values, based on anthropometric studies by Farkas et al. (1986), for North American adults of white ethnicity are 31.6° ± 4.6° in males and 30° ± 5.3° in females. There is ethnic variability, and average values for a Chinese population have been provided as 27.2° ± 3.5° in males and 24.5° ± 3.6° in females, and in an African American population as 32.2° ± 5° in males and 33.4° ± 5.7° in females (*Farkas*, 1994).

The diagnosing surgeon should keep in mind that the nasofacial angle is but one of myriad facial aesthetic parameters that the treating surgeon must evaluate. A number of other nasal and nasofacial angles and proportional parameters should also be evaluated. These include the nasofrontal angle, nasal dorsal contour, supratip morphology, nasal tip rotation, nasal height to projection ratio, nasal projection to length ratio, nasal columella-lobular angle,

nasolabial angle, and vertical and transverse proportions of the nose in relation to the face. In addition, the aesthetic relationship between the nose and the other five facial profile prominences, namely, the forehead and supraorbital ridge, the lips, chin, and submental-cervical region, must also be taken into account, to achieve the most harmonious surgical outcome *(Naini, 2011)..*

It is important to bear in mind that the profile silhouette image created was based on North American white adult male proportions and normative values. As such, it is not generalizable to different ethnic groups, and the data may not be directly relevant to other ethnic groups, although it does provide an insight into how different ethnic groups view faces of white ethnicity. It would be interesting to repeat the study using images from different ethnic groups.

<u>CONCLUSIONS</u>

The results demonstrate that a nasofacial angle of approximately 30° is ideal, with a range of 27° to 36° deemed acceptable. Angles above or below this range are perceived as unattractive, and anything outside the range of 21° to 42° is deemed very unattractive. Excessive nasal prominence, with a nasofrontal angle of 48°, was deemed the least attractive. In terms of threshold values of desire for surgery, for all groups a threshold value of ≧39° and ≦24° indicated a preference for surgery, although clinicians were the least likely to suggest surgery. For many of the images, there was generally good agreement among clinicians and laypersons as to whether surgery was required. There was more variability in the assessments for the patient group. This stresses the importance of using patients as observers, as well as laypersons and clinicians, in facial attractiveness research.

13

Conflict of interest

There is no conflict of interest for any author.

REFERENCES

Farkas LG: Anthropometry of the attractive North American Caucasian face. In: Farkas LG, (ed.), Anthropometry of the head and face, 2nd edition. New York: Raven Press, 159-180, 1994.

Farkas LG, Kolar JC: Anthropometrics and art in the aesthetics of women's faces. Clin Plast Surg. 14:599-616, 1987.

Farkas LG, Kolar JC, Munro IR: Geography of the nose: a morphometric study. Aesthetic Plast Surg. 10:191-223, 1986.

Ioi H, Nakata S, Nakasima A, Counts A: Effect of facial convexity on antero-posterior lip positions of the most favored Japanese facial profiles. Angle Orthod. 75:326-332, 2005.

Langlois JH, Kalakanis L, Rubenstein AJ, Larson A, Hallam M, Smoot M: Maxims or myths of beauty? A meta-analytic and theoretical review. Psychol Bull. 126:390-423, 2000.

Lehocky BE: Anthropometry and cephalometric facial analysis. In: Mathes SJ (ed.). Plastic Surgery, 2nd edition. Vol. II. Philadelphia: Saunders Elsevier, 1-30, 2006.

Naini FB: Facial Aesthetics: Concepts and Clinical Diagnosis. Oxford: Wiley-Blackwell, 2011.

Naini FB: Leonardo da Vinci's aesthetic analysis of nasal tip prominence. Arch Facial Plast Surg. 14:463-464, 2012.

Naini FB: The origin of the zero-degree meridian used in facial aesthetic analysis. Aesthet Surg J. 34:NP72-3, 2014.

Naini FB, Cobourne MT, Mcdonald F, Donaldson AN: The influence of craniofacial to standing height proportion on perceived attractiveness. Int J Oral Maxillofac Surg. 37:877-885, 2008.

Naini FB, Donaldson ANA, McDonald F, Cobourne MT: Assessing the influence of chin prominence on perceived attractiveness in the orthognathic patient, layperson and clinician. Int J Oral Maxillofac Surg. 41:839-846, 2012.

Papel ID, Capone RB: Facial proportions and esthetic ideals. In: Behrbohm H, Tardy Jr ME, (eds.). Essentials of Septorhinoplasty. New York: Thieme, 65-74, 2004.

Pearson DC, Adamson PA: The ideal nasal profile: rhinoplasty patients vs. the general public. Arch Facial Plast Surg. 6:257-262, 2004.

Pitak-Arnnop P, Hemprich A, Dhanuthai K, Yildirim V, Pausch NC: Panel and patient perceptions of nasal aesthetics after secondary cleft rhinoplasty with versus without columellar grafting. J Craniomaxillofac Surg. 39:319-325, 2011.

Powell N, Humphreys B: Proportions of the Aesthetic Face. New York: Thieme, 1984.

Rees TD: Aesthetic Plastic Surgery. Vol. 1. Philadelphia: WB Saunders Company, 1980.

Roxbury C, Ishii M, Godoy A, Papel I, Byrne PJ, Boahene KD, Ishii LE. Impact of crooked nose rhinoplasty on observer perceptions of attractiveness. Laryngoscope. 122:773-778, 2012.

Sheen JH: Aesthetic Rhinoplasty. Vol. 1. Saint Louis: CV Mosby Company, 1978.

Springer IN, Wannicke B, Warnke PH, Zernial O, Wiltfang J, Russo PA, Terheyden H, Reinhardt A, Wolfart S. Facial attractiveness: visual impact of symmetry increases significantly towards the midline. Ann Plast Surg. 59:156-162, 2007.

Springer IN, Zernial O, Warnke PH, Wiltfang J, Russo PA, Wolfart S: Nasal shape and gender of the observer: implications for rhinoplasty. J Craniomaxillofac Surg. 37:3-7, 2009.

Sringer IN, Zernial O, Nölke F, Warnke PH, Wiltfang J, Russo PA, Terheyden H, Wolfart S: Gender and nasal shape: measures for rhinoplasty. Plast Reconstr Surg. 121:629-637, 2008.

Springer IN, Schulze M, Wiltfang J, Niederberger U, Russo PA, Möller B, Wolfart S: Facial self-perception, well-being, and aesthetic surgery. Ann Plast Surg. 69:503-509, 2012.

Springer IN, Wiltfang J, Kowalski JT, Russo PA, Schulze M, Becker S, Wolfart S: Mirror, mirror on the wall…: self-perception of facial beauty versus judgement by others. J Craniomaxillofac Surg. 40:773-776, 2012.

Figure 1.   Nasofacial angle (NFA).

Figure 2.   The nasofacial angle of the idealized profile image was altered incrementally, creating a series of images.

Figure 3.   Example of an image viewed by study observers on the monitor during data collection.

Table 1. Observer demographics

Observer group	Number	Mean age (years)	95% CI	Age range	Gender (% male)	Ethnicity (% white)
Orthognathic patients	75	22	20–24	13-60	42	66
Laypersons	75	31	28–35	16-79	31	49
Clinicians	35	31	30–33	24-39	33	72

CI, confidence interval.

Table 2. First and third quartile rankings of the Likert score

		First quartile			Third quartile		
Image	Angle (°)	Patients	Laypersons	Clinicians	Patients	Laypersons	Clinicians
BL	30	4	5	5	6	6	6
CL	33	4	4	4	5	6	6
DN	36	3	3.25	3	5	5	5
EM	36	3	3	3	4	5	4
FL	39	2	2	2	4	4	3.75
GQ	42	2	1.25	2	3	3	2
HS	45	1	1	1	2	2	2
JU	48	1	1	1	2	2	1
KJ	27	4	4	4	5	6	5.75
LI	24	2	2	2	3.75	3	3
MJ	21	1.25	2	2	3	3	2

Table 3. Median attractiveness observer ratings on the Likert scale

Image	Angle (°)	Median score		
		Patients	Laypersons	Clinicians
BL	30	5	5	6
CL	33	5	5	5
DN	36	4	4	3
EM	36	4	4	4
FL	39	3	3	2
GQ	42	2	2	2
HS	45	2	2	1
JU	48	1	1	1
KJ	27	5	5	4
LI	24	3	3	3
MJ	21	2	2	2

Table 4. Data in rank order from most to least attractive (clinician ranking first)

		Median score		
Image	Angle (°)	Patients	Laypersons	Clinicians
BL	30	5	5	6
CL	33	5	5	5
KJ	27	5	5	4
EM	36	4	4	4
DN	36	4	4	3
LI	24	3	3	3
FL	39	3	3	2
GQ	42	2	2	2
MJ	21	2	2	2
HS	45	2	2	1
JU	48	1	1	1

Table 5. Proportion expressed as a percentage of each observer group suggesting a desire for surgery

| Image | Angle (°) | Suggesting surgery | | |
		Patients	Laypersons	Clinicians
BL	30	13	5	0
CL	33	15	7	0
DN	36	39	23	20
EM	36	41	17	20
FL	39	53	51	69
GQ	42	76	80	94
HS	45	88	96	100
JU	48	89	99	100
KJ	27	19	8	9
LI	24	60	64	63
MJ	21	69	81	91

Table 6. Proportion expressed as a percentage of each observer group suggesting a desire for surgery in rank order

Image	Angle (°)	Suggesting surgery		
		Patients	Laypersons	Clinicians
BL	30	13	5	0
CL	33	15	7	0
KJ	27	19	8	9
EM	36	41	17	20
DN	36	39	23	20
LI	24	60	64	63
FL	39	53	51	69
MJ	21	69	81	91
GQ	42	76	80	94
HS	45	88	96	100
JU	48	89	99	100

Table 7. Proportion of observers desiring surgery who considered attractiveness to be important

Image	Angle (°)	Suggesting surgery		
		Patients	Laypersons	Clinicians
BL	30	13	1	0
CL	33	15	3	0
DN	36	41	20	20
EM	36	42	14	20
FL	39	54	49	69
GQ	42	78	80	94
HS	45	90	96	100
JU	48	90	99	100
KJ	27	21	4	9
LI	24	62	63	63
MJ	21	71	82	91

Table 8. Proportion of observers suggesting surgery who did not consider attractiveness to be important

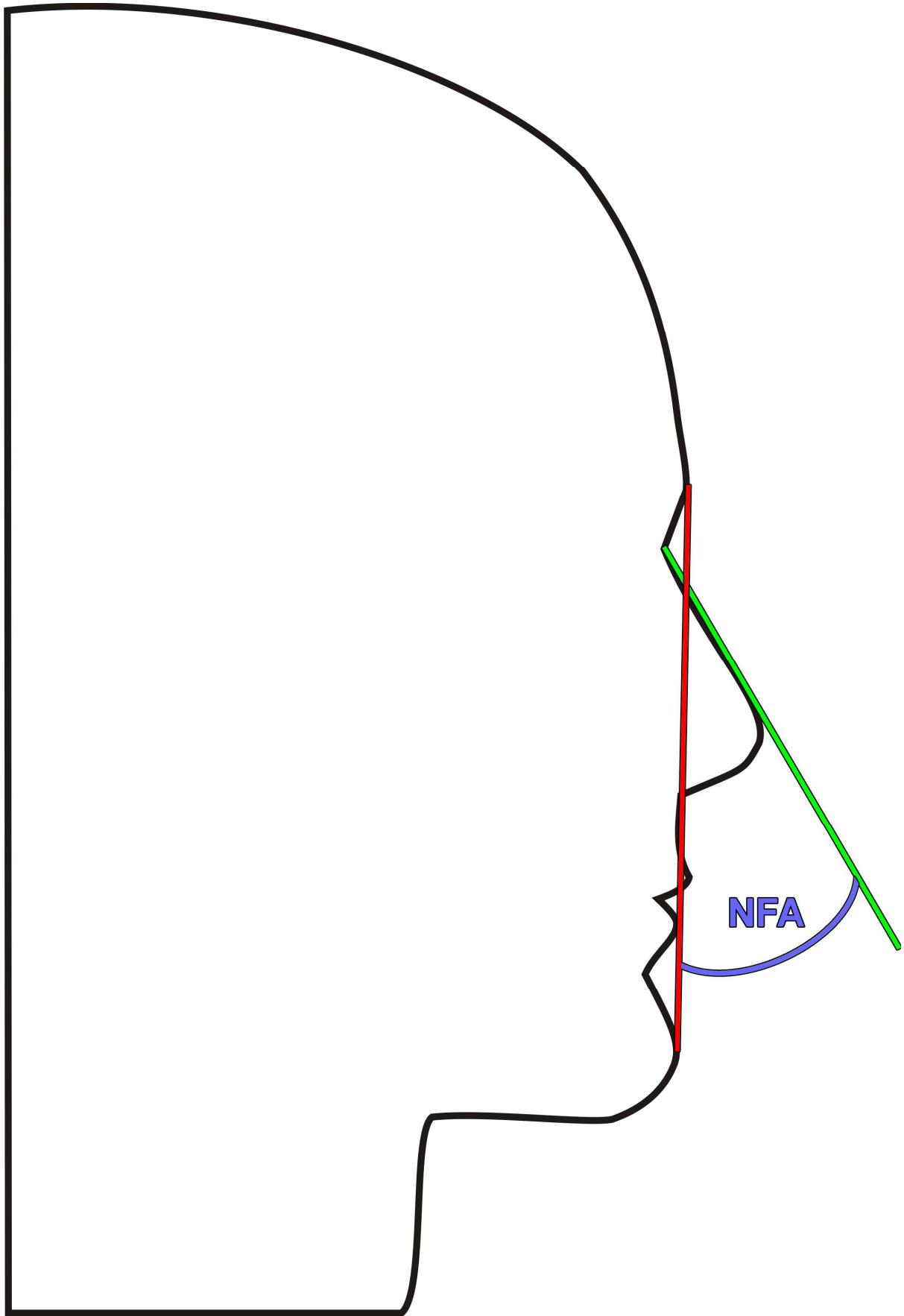| Image	Angle (°)	Suggesting surgery	
		Patients	Laypersons
BL	30	14	75
CL	33	14	75
DN	36	14	75
EM	36	29	75
FL	39	43	75
GQ	42	57	75
HS	45	71	100
JU	48	86	100
KJ	27	0	75
LI	24	43	75
MJ	21	57	75

Table 9. Nasofacial angle in idealized images from classical and Renaissance art and
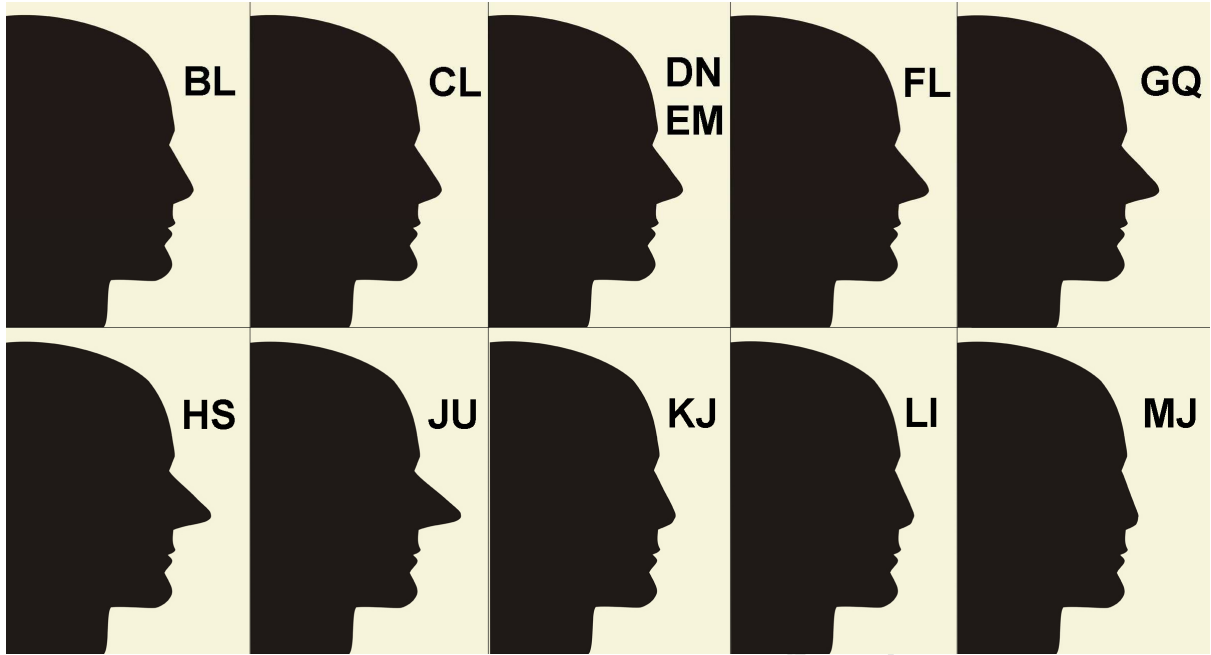
sculpture

Artwork	Artist	Era	Nasofacial angle (°)
Doryphorus (Pompeii, now in Naples)	Polycleitos of Argos	Classical Greece	30
Heracles (Naples)	Polycleitos of Argos	Classical Greece	25
Idolino (Florence)	Unknown (After Polycleitos)	Classical Greece	25
Hermes	Apollonius	Classical Greece	30
Leonardo's Angel (female head, from Annunciation)	Leonardo da Vinci	Italian Renaissance	25
Head of a youth in profile (male head)	Leonardo da Vinci	Italian Renaissance	20
Head and shoulders of a youth in profile (male head)	Leonardo da Vinci	Italian Renaissance	25
Study of the valves and muscles of the heart (male head in profile)*	Leonardo da Vinci	Italian Renaissance	30
Woman's head in profile**	Leonardo da Vinci	Italian Renaissance	30
La Bella Principessa	Leonardo da Vinci	Italian Renaissance	35
Idealised head of a woman	After Leonardo da Vinci (unknown artist)	Italian Renaissance	25
Head of a woman in	Giovanni Antonio	Italian	25

profile	Boltraffio	Renaissance	
David	Michelangelo Buonarroti	Italian Renaissance	25
Primavera (Middle sister, profile)	Botticelli	Italian Renaissance	30
Woman's profile (from The Three Ages of Man)	Titian	Italian Renaissance	30

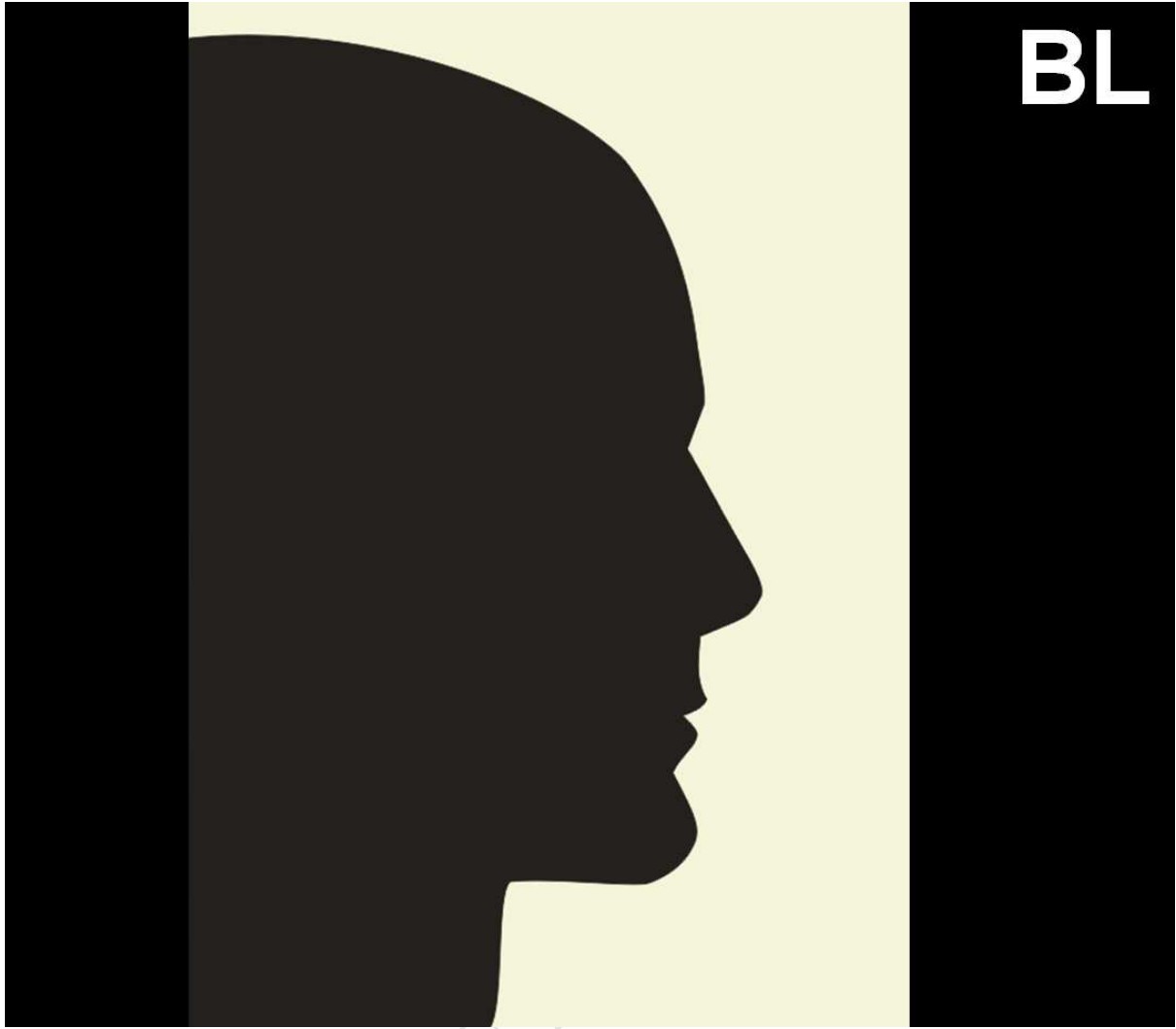*This profile drawing is the first illustration of the later described zero-degree meridian line (*Naini*, 2014).[11]

**This profile drawing was used famously by Jacques Joseph to demonstrate an ideal nasofacial angle (*Naini*, 2011; *Naini*, 2012).[3,12]