# ANALYSIS OF THE FACE AND NOSE

C. A. Tucker, Hartford, Conn., U.S.A.

## Analysis of the face and nose

In surgery involving reconstruction of the nasal septum and its related structures, alterations in the appearance of the external nose may occur — purposefully or not. It is essential, therefore, that the surgeon acquaint himself with an analysis of the face and nose. This study adds to the total knowledge of the patient and should be correlated, if possible, with the etiology of the patient's functional disturbance if one is present. Many methods have been devised to accomplish this objective, but the purpose of this presentation is to summarize those studies which have proven to be of value to scores of rhinologists over many years.

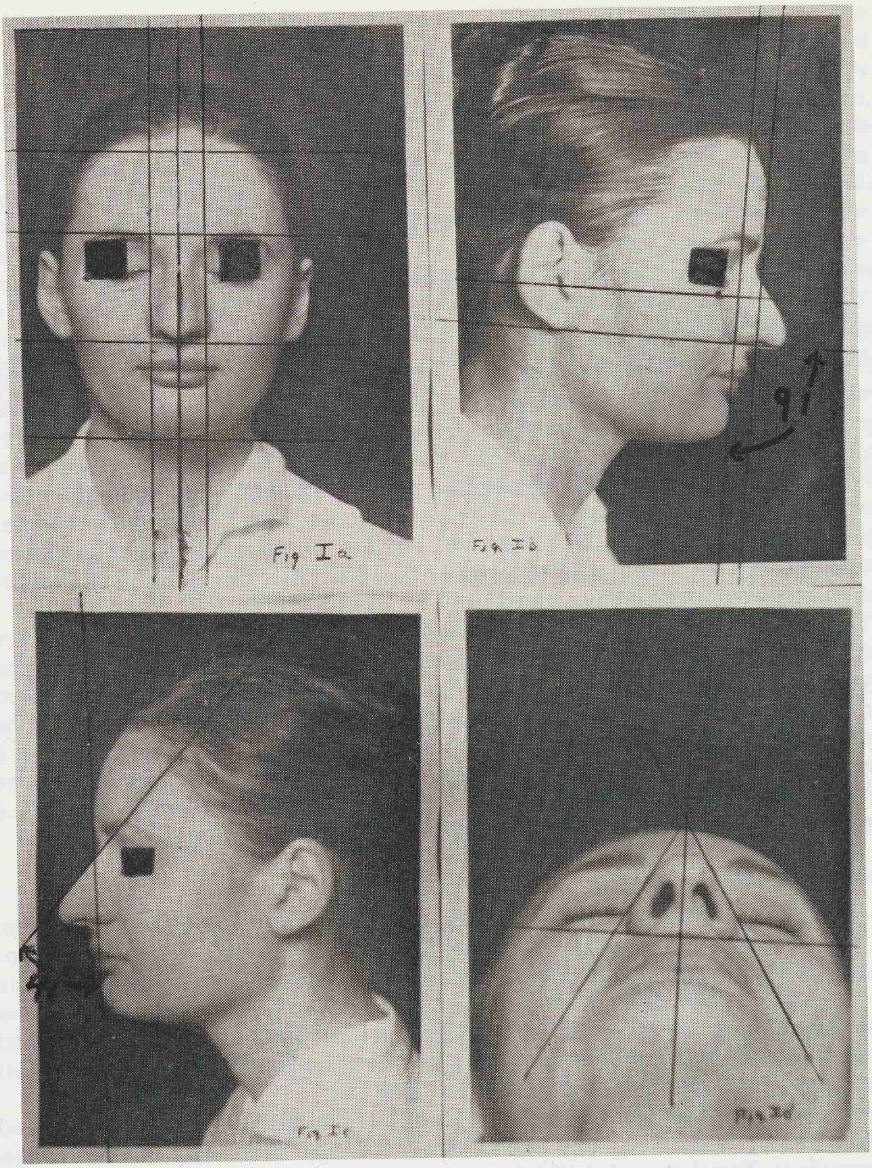
This problem is approached by several methods. One is a study of what Brown and McDowel (1951) has called the contour anatomy of the nose and its relationship to the face. Another is by the study of certain nasal indices as outlined by Cottle (1952-1967) and the third a detailed minute examination of the various parts of the nose itself. Of special importance and consideration is a knowledge of asymmetry. These objectives when carefully worked out and correlated one with another and with the patient's nasal function, lead to a better understanding of what may be accomplished by surgery.

## Contour anatomy

A rich heritage exists in the studying and analysing of the face and nose. It is profitable to spend time studying paintings or sculpture or their reproductions which may extend back for many centuries and this procedure is to be highly recommended. There are certain relationships of the nose to the face, the face to the head and the head to the body which are well documented and may be found in books on portraiture and sculpture. This has been well described by Broadbent and Mathews (1957).

Each patient should be studied by means of standard 5 x 7 inch black and white photographs. They are the full face, the right and left profiles and the base view. This latter should be reproduced actual size and the other three one-half actual size. In taking such pictures it is essential to make a mark on the infraorbital rim directly below the pupil of the right eye. These photographs are covered with transparent plastic paper, and by means of a china marking pencil certain guide lines are drawn. The most useful of these are as follows:

(Figure 1a): on the front face view, a line is drawn joining a point midway between the inner canthi and the midpoint of the upper lip or chin. Immediately it can be seen whether or not there is about an equal amount of nose and




face on the two sides of this line which gives an idea of symmetry especially as it is related to the midsagittal plane.
A line parallel to this is drawn through the inner canthus on each side. In general, the whole nose should fall within these two latter lines and there should be about an equal amount of nose on either side of the center line. It is to be noted that in certain races, the negro for example, the edges of the alae are wide but so is the space between the inner canthi.

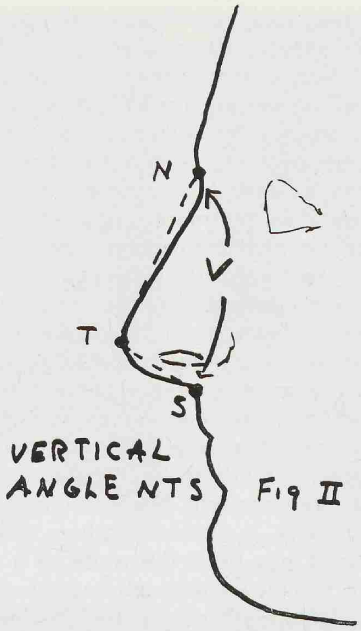
At right angles to the first line, four horizontal lines are drawn with a T-square or protractor. The first of these is at the hair line, the second at the level of the brows, the third at the base of the nose and the fourth at the tip of the chin. This then marks out three facial spaces, ideally about equal in size. However, it may be that the center space is long because of a larger or a long nose or short because of a small or a short nose. The length of the upper lip and the jaw can be seen in relationship to the other spaces. Again certain asymmetries may now be more apparent, especially those in the coronal plane in a caudal-cephalic direction. The right profile view is considered next (Figure 1b). The Frankfort horizontal line is drawn using the mark on the infraorbital ridge and joining this to the upper edge of the tragus. From this line a perpendicular is drawn. It will be useful to have this tangential to the glabella for an additional study described later. A line is drawn through the length of the nostril. The angle formed between this latter line and the perpendicular to the Frankfort horizontal line is an angle called the naso-labial angle and can be measured. In men, it is usually 85 to 90 degrees, and in women 95 to 105 degrees. In children, it tends to be 100 degrees or greater. It reflects quite well the bony structures beneath. For example, in the white person with a prominent spine and maxilla, it is more obtuse. In the negro with a small spine, it is more acute as it may be in the white as a result of injuries to the anterior nasal septum. In this view the length and the shape of the nostril, the length of the upper lip, the prominence of the columella and its relationship to the ala and of these two to the tip of the nose are noted.

In the left profile view (Figure 1c) a line is drawn from the glabella to the chin and another from the depth of the nasal angle along the prominence of the dorsum. The angle formed is measured and is called the naso-frontal angle, normal being considered from 30 to 36 degrees. Numerous variations may occur depending upon ethnic origin and prior injury.

A study of the base view (Figure 1d) comes under consideration next. A line is draw at the base of the nose from the lowest part of the junction of the ala and face. A perpendicular is raised at a point midway between these points and the tip of the nose can be observed in relationship to this. Lines are drawn tangential to the lateral walls of the lobule making a triangle and these angles may be measured. If symmetry is present, the perpendicular line mentioned above should bisect the apex of this triangle.

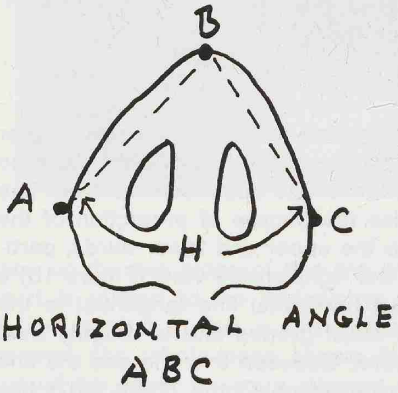
**Salience**

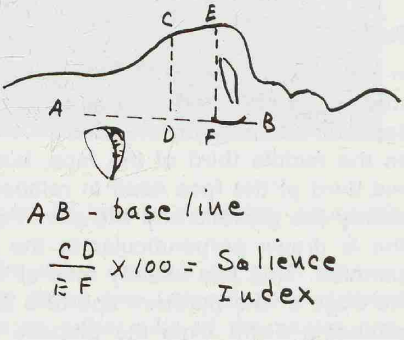
In order to determine the amount of the projection of the nose, certain other studies are indicated. This is complicated because of the fact that the salience depends not only on the amount of projection of the nose from its base line on the middle third of the face, but includes the degree of projection of the mid third of the face itself in relationship to the upper and lower thirds, particularly the glabella and the chin. Again in the right profile view (Figure 1b) a line is drawn perpendicular to the Frankfort horizontal line tangential to the gnathion. This line usually falls at the alar-facial groove and is roughly over the edge of the pyriform aperture at this point. Between this line and the line extending down from the glabella is a space which Cottle (1952-1967) has named the frontal space. The line from the glabella normally just about bisects the nose. Variations from this are common. For example, in prognathism, the




chin line is shifted well forward, whereas in micrognathia, it may be well behind the usual position. With marked nasal projection, a large percentage of the nose will fall anterior to the frontal line, and with the nose with less than normal projection, most of it will fall behind this line.

There are two angle measurements which may be quite helpful. The first of these is the vertical angle (Figure 2). If a line is drawn from the tip of the nose to the nasale and another from the tip of the nose to the sub nasale, the angle formed at the tip is known as the vertical angle (NTS in Figure 2). This gives an idea of the amount of projection of the tip without consideration of any marked irregularity of the nasal dorsum and it places the tip in relation-



ship to the nasale and sub nasale. In the negro the angle is greater than 79 degrees and in the white is less than 90 degrees. A similar study may be made from the base view (Figure 3) and is called the horizontal angle. If a line is drawn from the greatest width of the base to the tip on each side and this angle then measured (ABC in Figure 3), it will be found that in the negro it is usually greater than 70 degrees and in the white less than 70. Again this gives some idea of the amount of lobule projection but in this regard, it must be related to the width of the lobule as well.

A third study of nasal salience is possible (Figure 4) by measurements of projection of the nose starting at the base line of the nose. A line is drawn extending from the alar-facial groove to just within the inner canthus. From this line a measurement is made of the greatest height or prominence of the nasal dorsum and will usually fall between 23 and 30 millimeters. The second extends from the base line to the nasal tip and usually measures between 34 and 43 millimeters. The first measurement divided by the second multiplied by 100 yields what Cottle (1952-1967) has named the salience index. Variations between the two sides become apparent especially when there is an anterior posterior asymmetry.

Thus there evolve three measurements of nasal salience. The first is the nose as related to the other compartments of the face and specifically compared to the prominence of the glabella and the gnathion. The second relates the nasal tip to the nasale and sub nasale and the third is a measurement of nasal projection as it relates to the middle compartment of the face, as well as the ratio of the prominence of the nasal dorsum to the tip.

**The nasal angle**

Of particular interest is the nasal angle as described by Cottle (1952-1967). Descending from the glabella in the midline (Figure 5) the contour of the face and nose dips posteriorly, as a rule, before arising anteriorly again to form the prominence of the nasal dorsum. The point of greatest recession is the apex of the nasal angle with one arm of the angle extending cephalically to the glabella and the other following the midline of the dorsum caudally to a level between the inner canthi. The amount of angulation may vary, as may the length of the arms, but it is to be noted that the nasale and underlying

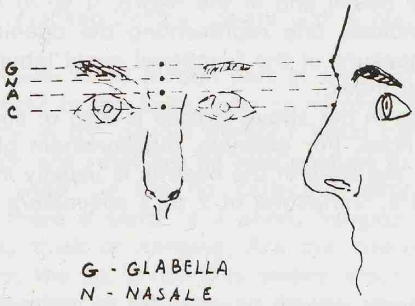



FIG V

nasion is cephalic to the apex of this nasal angle, placing the apex at the level of the body of the nasal bones rather than the frontal bone or the nasofrontal junction. Surgery of the nasal angle, therefore, is almost always within the nasal bones and not the nasal process of the frontal bone. And although we measure the length of the nose from the nasale to the tip, the apparent length extends from the apex of the nasal angle to the tip. Thus, in surgical manipulations of this area, the apparent length of the nose can be made longer or shorter by placing this angle cephalically or caudally as desired.

**The nasal indices** (Cottle, 1952-1967)

Of considerable value and in an attempt to correlate a patient's ethnic origin with his contour anatomy and his nasal function, certain nasal measurements will be found to be of value.

In order to obtain some idea of the height of the internal nose in relationship to its width, we use the clinical nasal index. This is a measurement not of the pyriform aperture but rather of the nasal aperture, the dividing line between the external and the internal nose. A mark is placed on the nasale. This may be determined as a point in the mid line of the nose at the same level as the suprapalpebral folds with the eyes open. Another mark is made at the subnasale which is the spot on the skin over the center of the base of the spine. This distance is measured and recorded in millimeters.

The greatest width of the pyriform aperture is then determined by palpation and with the palpating fingers in position, marks are made on the skin and measurements then again carried out. This latter measurement, the measurement of the width divided by the previous measurement, the height, multiplied by 100 is the clinical nasal index.

This index will vary depending upon the ethnic origin of the patient. In leptorrhines, it will be 61 or less, in mesorrhines, it will be 61 to 65, and in platyrrhines, it will be 65 to 80 or more.

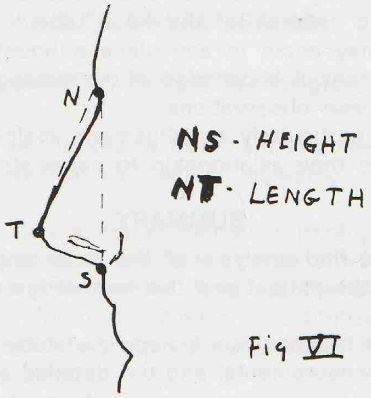
Another measurement of importance in correlating the ethnic origin of a patient with the function and anatomy of his nose is the tip index. This is determined first by measuring the greatest width of the base above the apex of the nostril and dividing this measurement by the greatest width below the base of the nostril. This is then multiplied by 100 to determine the tip index. In the white, it is 70 or below and in the negro, it is 70 or above. A comparison of these two indices, one representing the opening of the internal nose and the other a measure of the functional nasal lobule results in a still third index, the harmony index.

The actual measurements in the above indices is also of importance in determining the size of the nose. For example, measurement of the width of the base of the nose above the apex of the nostrils is usually in the normal white male about 25 millimeters. Variations of 2 to 3 millimeters from this may be of significance.

**Other measurements**

Certain other measurements will be found to be of interest. If one measures from the nasale to the tip and then from the tip to the subnasale, a certain ratio will be found. Also, the sum of these two measurements will give some idea of the overall size of the contour of the nose.

In determining whether the nose is long or not, we can compare the measurements of the distance of the height and length of the nose (Figure 5). The height of the nose is measured by the distance between the nasale and sub nasale and the length of the nose measured from the nasale to the tip. In the long nose, the length is greater then the height.




**Detailed examination of the nose**

The third method of analysing a patient's nose and face is a detailed examination and it is useful to record this on a suitable form. The general size and shape of the nose and face is noted. In examination of the dorsum it is determined whether a C-shaped curve is present or a reverse C, or an S-shaped curve or a reverse S. It is noted whether the nose leans or deviates to one side or the other. The condition of the skin and subcutaneous tissue is noted and the presence of scar tissue is recorded. After observing the nose as a whole, it is convenient to divide the nose into three parts and study in order; the bony vault, the cartilaginous vault and the lobule.

The bony vault: Is a hump present, a deflection, wide base, wide dorsum, bony deficiencies of the dorsum? Is there tilting or leaning, or a long side or a short side? This can be outlined on the patient with a marking pencil and can be photographed.

The cartilaginous vault: Does it form part of a hump? Is sagging or saddling or deflection present? Is the base wide or narrow? Is there undue stiffness present, particularly in the caudal portion? What can be determined of the septum by palpation and what are its relationships to the cartilaginous vault?

The lobule: Is it wide? Is the tip deflected, depressed, cleft, widened?

The columella: Is there a cleft? Is it short, hanging or retracted?

The alae: Are they thick or hanging. Are the insertions of the feet of the alae into the cheek, the lip, or do they sweep around toward the columella? What is the relationship of the alae to the columella? (Griesman, 1950).

The nostrils: What is their shape? Are they triangular, square, circular, oval or uneven? Do they occupy a small or a large part of the base of the nose? Is there a fullness or bunching in the sub nasale area and upper portion of the

philtrum? Are the lobular cartilages thick, wide, stiff or ballooned? Are they equal to one another? What is the condition of the membranous septum? Is it loose, tight or redundant?

## ASYMMETRY

Of special interest in nasal and facial analysis is the recognition of asymmetry. This applies not only to the nose and the face, but also its relationship to posture. Tilting and rotation of the head, shoulders and torso may be present. Asymmetry may occur in any plane although sagittal malalignment may be the most apparent. A knowledge of the midsagittal points on the skull and face will aid in these observations.

Dental abnormalities, particularly malalignment, malocclusion and diastema, should be observed in their relationship to nasal structural defects.

## SUMMARY

The rhinologist should find analysis of the nose and face an integral part of his examination of the patient and this knowledge should aid in diagnosis as well as treatment.

Various approaches to this analysis including a study of the profile anatomy, the value of certain measurements, and the detailed examination of the nose has been presented.

## RÉSUMÉ

Lorsqu'on envisage une opération du nez, une étude de la face et du nez doit être faite en relation avec l'étiologie de la pathologie du malade afin d'avoir une compréhension globale du problème. On doit étudier l'anatomie de surface, certains index du nez et les différentes parties du nez. Il faut insister sur les assymétries du nez et de la face. On utilise des photographies 5″ x 7″ en blanc et noir, afin d'apprécier les différentes parties de la face et certains éléments du profil tel l'angle nasolabial et l'angle frontal. Insistons sur la projection du nez par rapport au plan de la face appelé ″saliance″. L'angle nasal, tel que décrit par Cottle, a été étudié en détail de même que les différents indices cliniques du nez. On a insisté sur l'examen en détail de chaque partie du nez et des rapports de ces parties avec le nez dans son ensemble. On peut faciliter cet examen en se servant de crayon gras pour indiquer certaines structures. On a parlé brièvement de la notion d'assymétrie. Cette assymétrie peut s'appliquer au nez mais également à la face et au thorax.

## REFERENCES

1. Brown, J. B. and McDowell, F., 1951: Plastic surgery of the nose. C. B. Mosby Company, St. Louis, Missouri.
2. Cottle, M. H., 1952-1967: From numerous course notes on reconstructive surgery of the nasal septum and closely related structures.
3. Broadbent, T. R. and Mathews, V. L., 1957: Artistic relationships in surface anatomy of the face: Application to reconstructive surgery. Plastic and reconstructive surgery 20, 1.
4. Griesman, B. L., 1950: Base of the nose: Anatomy and plastic repair. Arch. Otolaryng., 51, 541-556.

85 Jefferson Street,
Hartford, Connecticut, U.S.A.