

The Nose and its Clinical Implications in Orthodontics: An Overview

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Abstract:

The nose with a central position in the face, plays a major role in facial esthetics and thereof in treatment planning. With a growing number of patients seeking orthodontic treatment for esthetic reasons, it is of prime importance to have a sound understanding of what constitutes ideal soft tissue harmony. The nose with its protrusive structure must be envisioned with its composite supportive framework which is a major determinant of its shape.

Keywords: Esthetics, Nose, Orthodontics, Profile.

Introduction

Facial harmony in orthodontics is determined by the morphological relationships and proportions of the nose, lips and chin. According to Profitt, the basis of the practice of orthodontics is changing rapidly as a result of 3 major influences albeit the biologic revolution: the recognition that the facial soft tissues are the primary focus of orthodontic treatment; and the growing reliance on evidence-based rather than opinion-based orthodontic research.¹

Size, shape and position of the nose determine the esthetic appearance of the face especially in profile view (Fig. 1 and 2).² The assessment of the nose in the prognosis of an orthodontic case is therefore of special clinical importance. Treatment decision making must be determined by what is esthetically appealing than what the cephalometric norms may be.

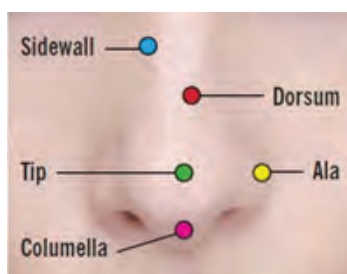


Fig.1: Landmarks on the Nose²

Anatomy of Nasal Region

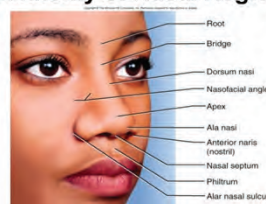


Fig.2: Landmarks on the nose as seen in three quarter view²

Discussion

The surface of the nasal pyramid offers some points, lines, and areas for consideration:³

1. Alar base width-

The width of the alar base should be equal to intercanthal distance which should be equal to width of an eye. If the intercanthal distance is smaller than an eye width, better to keep the nose slightly wider than the intercanthal distance. Significance of alar base width in orthognathic surgery is that the movement of the maxilla in lefort 1 osteotomies often results in widening of the nasal base (Fig. 3).³

2. Alar crease junction
3. Alar groove
4. Alar
5. Columella
6. Columellar base
7. Columella outline
8. Footplates of the medial crura
9. Glabella
10. Nasal base line
11. Nasal dorsum outline
12. Nasal lobule
13. Nasal lobule outline
14. Nasal radix outline
15. Nasal "unbroken" line
16. Nasion
17. Nostril sill

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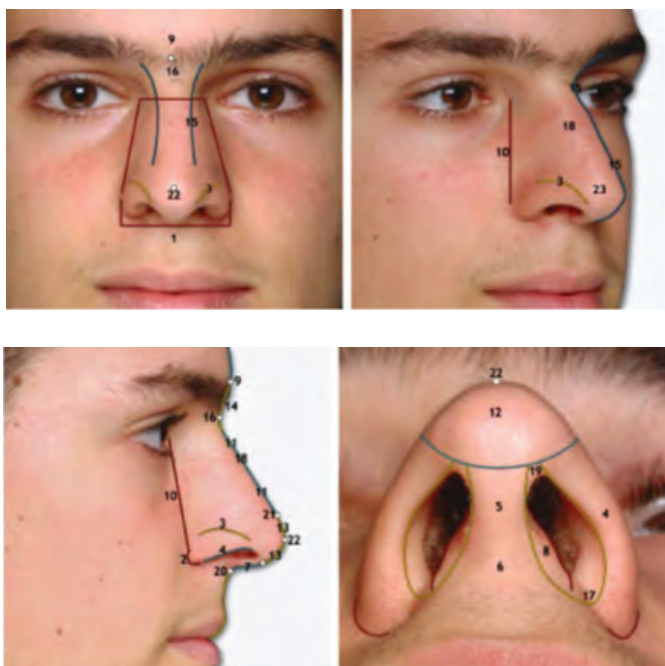


Fig.3 : Points on the nasal pyramid ³

18. Rhinion (clinically this is evaluated with direct palpation of the dorsum)
19. Soft triangle or facet
20. Subnasale
21. Supratip area or supratip breakpoint in clinical cases where a clear step over the nasal tip is present
22. Nasal tip
23. Tip defining points

Growth of Nose

A study by Hans peter et al was conducted to evaluate for the age changes in morphology and position of nose with reference to pterygomaxillary plane. It was found that increments in nose height, depth and inclination are complete in girls by 16 years of age while continuing to increase in males upto and beyond 18 years. Multiple linear variables were measured as shown in (Fig.4)⁴.

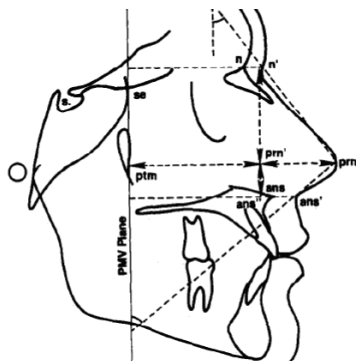


Fig.4: Linear variables measured ⁴

Ratio of **upper**($n'-pm'$), to **lower nose height**($pm'-ans''$), remained approximately 3:1 from 7 to 18 years in both sexes .Ratio of nose depth($pm'-pm$), to sagittal depth($PMV-pm'$); of underlying skeleton changed from 1:2 at 7 years to 1:1.5 in male subjects especially after 10 years. Persons with greater increments in nose depth than nose height , or in nose depth than in sagittal depth of underlying skeleton develop large upper nose inclinations.

Clinical Implications- Forward and downward growth displacement of the nose tip results in a gradual increasing retrusion of the lips relative to the nose. Growth changes in nose height and depth are therefore clinically relevant in determining the post orthodontic position of lips. Age changes in these variables were essentially complete by 16 years in female subjects ,while continuing growth was evident in male subjects upto and beyond 18 years. Orthodontic treatment objectives should be age specific to achieve a harmonious relationship among nose, lips and chin at the end of growth.⁵

Nasal Spurt- In both males and females nose grows more vertically than in anterioposterior projection. Boys have an spurt as early as age 10 and as late as age 15-16 years. Girls do not exhibit much nasal growth and do not have an adolescent spurt. The growth of nose is largely in its cartilaginous and soft tissue portions. Most growth in length is completed by age 10. Nasal dimensions increase at rate about 25% greater than growth of maxilla. Shape changes also occur because nasal dorsum rotates relative to the nasal tip. Upper nasal dorsum rotates upwards and forwards (counterclockwise) between ages 6 to 14,which leads to development of what can become a pronounced dorsal hump .⁶

Nasal Growth And Its Contribution To Profile- Class II patients exhibited a more pronounced elevation of the bridge of the nose than class-I. The dorsum of the class-II shows an increased general convexity. Class-I tend to have straighter noses. According to Subtelny the vertical dimension of the nose experiences more growth than the anterio-posterior projection in both males & females. There is a spurt in males nasal growth from 10-16 with the peak around 13-14 years. This is of importance because an orthodontist treating a class-II girl in that age group could expect only minimal increase in nasal projection over the next few years. However in a male of similar age any treatment that causes upper lip retraction in combination with several mm of nose growth remaining, might produce less than optimal final relationship between the lips and nose.

The increased prominence of the nasal hump in boys coincides with pubertal spurt and nasal projection in girls peaks between 9-10 years.⁷

How Does the Nose change with age?

Different areas of the nose change in different ways. The nose is supported by an underlying bony cartilaginous framework. The top part of the nose is supported by bone while the lower part near the nostrils is supported by cartilage (Fig.5).

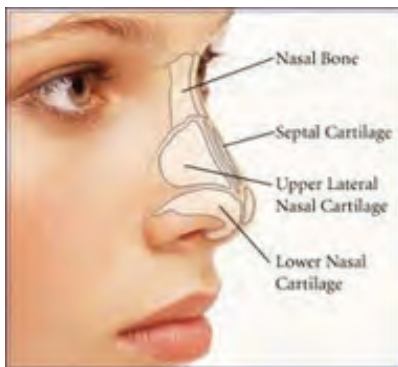


Fig.5 : Cartilaginous framework of nose⁸

Overtime, the cartilage becomes weaker and this causes the tip of the nose to droop, otherwise known as tip ptosis. The bony part of the nose becomes weaker, but it does not move.

The skin of the nose actually becomes thinner, but the sebaceous component of the skin increases. The increase in the sebaceous skin makes the skin heavier and more vascular, which will cause the nasal tip to droop.

The bone that supports the nose from below, the maxilla, begins to reabsorb and shrink. This loss of support also contributes to tip ptosis.⁸

Does the Nose grow with age?

The answer to the question is both yes and no. As one ages, the nose does not grow, but it changes in shape, which often makes the nose appear larger.

As the support of the nasal tip weakens and the nose begins to fall, the nose appears longer from the side or profile view. Additionally, it will make an existing nasal hump appear larger or cause a small hump to appear as the tip falls.⁸

The arrow pointing down shows the direction of movement of the nasal tip as we age. The red line shows the outline of the anticipated appearance of the nose after the tip falls. This illustrates how the nose is longer from the side view and appears to grow as we age (Fig .6)⁸.

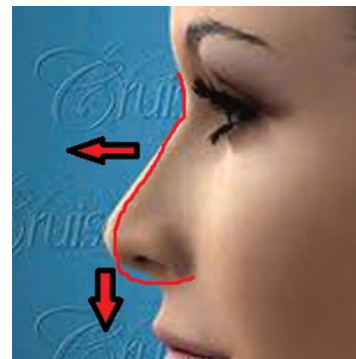


Fig.6: Direction of movement of nose with age⁸

Types of Nose

There are three major categories of nasal features according to racial background (Fig. 7)⁹

Leptorrhine-Usually found in whites and characterized by a long, narrow nose and nostrils.

Mesorrhine-Usually found in Asians and characterized by lack of dorsal height and columella support.

Platyrrhine-Usually found in blacks and characterized by a broad flat nose with wide nostrils.



Fig.7: Type of nasal features from inferior aspect a)Leptorrhine b)Mesorrhine c) Platyrrhine⁹

Nasal Index=Nasal breadth/Nasal length X100

Classification

Hyperleptorrhine (Very narrow nose)	->54.9
Leptorrhine (Narrow nose)	-55.0-69.9
Mesorrhine (Medium nose)	- 70.0-84.9
Platyrrhine or Chamorrhine (Broad Nose)	- 85.5-99.9
Hyperplatyrrhine (Very broad nose)	- 100.0-x

How does nose shapes co-relate with face?

In a study done by Robison JM et al¹⁰ it was seen that larger noses were larger in all profile dimensions. Patients with straight profiles tended to have straight noses; convex profiles accompanied convex nasal shapes; and concave profiles were found with concave nasal shapes.

In dolicocephalic facial form, naso-maxillary complex is in a more protrusive relation to mandible. While in brachycephalic facial form, naso-maxillary complex is short horizontally.

What variables change with age and how does it differ in both sexes?

In a study by Chiarella Sforza et al¹¹ normal sex-related dimensions of external nose (linear distances, ratios, angles, volume and surface area growth changes between childhood and old age were studied.

From the landmarks, nasal volume and external surface area; nasal and alar base widths, nasal height, nasal bridge length, philtrum length, nasal tip protrusion, right and left nostril lengths, superior and inferior nostril widths; nasal tip protrusion-to-nasal height, and nasal width-to-nasal height ratios; nasal convexity, alar slope, and nasal tip angles were calculated, and averaged for age and sex. On average, men had larger nasal external volume and area, linear distances and nasal width-to-height ratio than women ($p < 0.01$); no sex differences were found for the angles and the nasal tip protrusion-to-nasal height ratio. Nasal volume, area, linear distances increased from childhood to old age, while the nasal tip angle decreased as a function of age. No consistent age related patterns were found for the ratios and the nasal convexity and alar slope angles (Fig .8).

Men and women had different age related patterns, with significant sex by age interactions. Overall, in most occasions males had greater increments in nasal dimensions were larger than female ones.

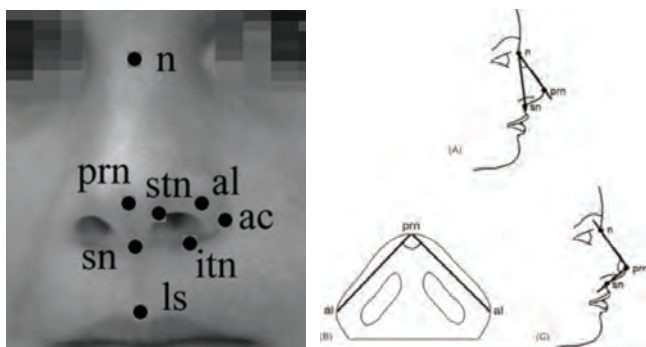


Fig.8 : Landmarks on the nose and analysed angles ¹¹



Fig. 9 :The visual effects of changing the nasal tip rotation (a), the upper lip length (b), the upper lip projection (c), and the profile contour at subnasale (d)³

Close relationship of nose with upper lip

Simply changing the observer's point of view in front of the subject, changes the relationship between the columella and the upper lip, the nostril show and also the light reflex over the tip. Every change in the volume, length, slope, and shape of the lower third of the nose influences how we see the volume, length, slope, and shape of the upper lip (Fig .9)³.

The opposite is also true. The basic knowledge of the visual interplay between the nasal tip, the columellar-lobule profile and length, the subnasale point or curve, the alar rim profile, the upper lip profile and length, and the labrale superior point can be simplified by altering one parameter at a time.

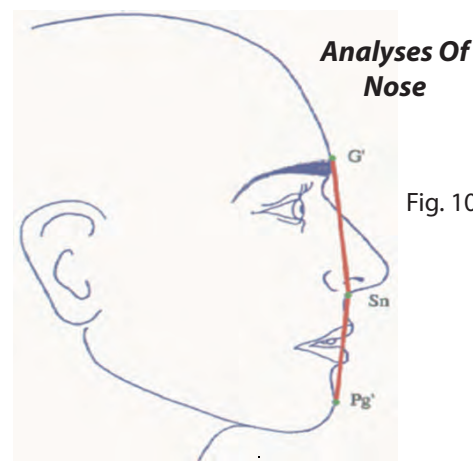


Fig. 10 : Profile angle ¹²

This is formed by connecting soft tissue glabella, subnasale, and soft tissue pogonion.1

Class I occlusion presents a total facial angle range of 165 to 175 degree. In class II less than 165 degree. In class III greater than 175 degree (Fig .10)¹².

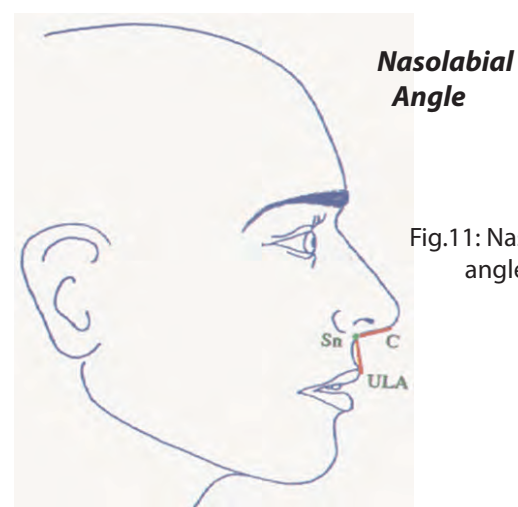


Fig.11: Nasolabial angle ¹²

- This is formed by the upper lip anterior and columella at subnasale (Fig. 11)¹². The normal range is 85 to 105 degree. Females have a greater range. Factors to be considered in treatment planning to correctly achieve this angle are:

- Existing angle
- Tipping versus bodily movement of maxillary teeth and its effect on lip position
- Estimation of lip tension present.

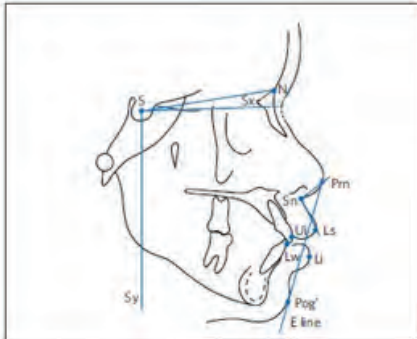


Fig.12: E-line¹⁴

- Amount of incisal retraction possible
- Extraction versus non extraction
- Extraction pattern

According to Robert Murray Ricketts¹³, the distance between the lower lip and esthetic (nose-chin) plane i.e. the E – line – extending from the soft tissue tip of the nose (En) to the soft tissue chin point (DT) is an indication of the soft tissue balance between the lip and the profile. The average norm for this measurement is –2.0mm at 9 years of age. The positive values are those ahead of the E-line (Fig. 12)¹⁴.

According to Bowker A Meredith¹⁵ the tip of nose grows with age as shown below :

	Age 5		Age 14		Growth in mm per year	
Tip of nose	23.8	24.8	30.9	32.3	7.7	7.5

Conclusion:

The nose is an important determinant in facial esthetics and needs to be evaluated based on age, gender, and racial background. Treatment planning should be done with the nose and its related changes with age, in mind.

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