

## Nose and Nasal Architecture: An ethnic variations

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### ABSTRACT

**Objective:** The objective of the study undertaken was to evaluate if geometric and mathematical relationship of Nose and Nasal Architecture of female population of three ethnic groups of Nepal. **Methods:** Sample consisted total of 135 Nepalese females in age group of 18-25 years belonging to three ethnic groups of Nepal. Each group comprised of 45 females. For the study extra oral facial photographs were obtained in Frontal View, Profile View, Sub MentoVertex View (Basal View). Evaluations were done using the Goode Method and Fomans Method. **Results:** Nasal Projection in tarai region females had maximum projection of the nose ( $61\% \pm 8$ ) followed by Hilly females ( $60\% \pm 5.50$ ) and least projection of nose was found in mountainous region females ( $50\% \pm 7$ ). Nasal Projection showed no significant difference in hilly and tarai Nepalese females but shows significant difference between hilly and mountainous region and mountainous region and tarai females. Analysis of nasal architecture reveals that mountainous region nose were shorter and broader than hilly and tarai region females. **Conclusions:** Evaluation of nasal architecture reveals that shape of nasal dorsum was straight in all three groups of Nepalese females studied. Columella to Lobe relationship showed that Columella was longest in tarai region females followed by hilly region females and shortest in mountainous region females.

**Key words:** Nasal Architecture, Ethnic variation, Photographic evaluation.

### Introduction

Beauty is the phenomenon of experiencing pleasure through the perception of balance. Beauty is admired due to its unique balance in nature. Evidences indicate that this balance and perception of beauty is due to the 'Golden' Number or the ratio that gives exquisiteness [1].

The 1992 textbook entitled Esthetics and the Treatment of Facial Form by Mcnamara includes interesting and important references related to the history of facial beauty. Literature evidences shows angular and linear analyses of the soft-tissue profile, exhibiting ethnic differences [2,3].

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The Nose and Nasal Architecture adds grace and uniqueness to human face. The morphological characteristics of nose are used in diagnosis and treatment planning in orthodontics. Literature evidences on linear and angular soft tissue profile analysis shows ethnic differences[2,3]. The nose is considered to contribute to this difference[4,5]. Though hard tissue cephalometrics remains the backbone of orthodontic diagnosis and treatment planning, the paradigm shift to soft tissue examination has added a new dimension to orthodontics. The soft tissue of a patient may contribute positively or negatively to facial esthetics. Racial characteristics also play a dominant role in esthetics. Nepal although being a small nation is composed of diverse ethnic groups. It is impossible to find out the exact origin of the people of Nepal.

As the nose has a major role in facial harmony and esthetics the study will also focus on evaluating the

nasal architecture. The objective of the study undertaken was to evaluate if geometric and mathematical relationship of Nose and Nasal Architecture of female population of three ethnic groups of Nepal .

This study was designed to test the null hypothesis that these geometric and mathematical relationships are not present in the Nepalese ethnic groups or to validate the research hypothesis that there are different proportions present in different ethnic groups and to evaluate the nasal architecture among different ethnic group of Nepal . In this study three ethnic groups selected Of Ethnic groups of mountain origin (Gurung, Magar, Limbu, Rai ,Thakali and Sherpa etc.) .The hill castes with largest social group with 40.3 percent of total population. These include Bahun, Chhetri, and Thakuri (30.6%), Newar as well as artisan castes Kami, Damai, and Sarki (8.7%). The population of tarai region has

numerous castes but the proportion of dominant castes, Brahmin, Rajput and Kayastha Tharu 6.6%, Muslim 4.4%, Yadav 4%[6,7].

### Material and Method

Department of Orthodontics and Dentofacial Orthopedics of Kathmandu Medical College, Bhaktapur, Nepal . Clearance from the IEC and informed consent from the participants were obtained. The sample consisted total of 135 Nepalese females in age group of 18-25 years belonging to three ethnic groups of Nepal . Each group comprised of 45 females. Females with no history of orthodontic treatment , history of maxillofacial surgery and no history of craniofacial anomalies were included in the study.

### Study Groups

**Table 1: Study groups**

Groups	Sample N=135	Sex
Hilly Region (HR)	N = 45	F
Mountainous Region (MR)	N = 45	F
Tarai Region(TR)	N = 45	F

### Method

For the study extra oral facial photographs were obtained in

- 1) Frontal View
- 2) Profile View
- 3) Sub Mento Vertex View (Basal View)

### Image Capturing Technique

- Photographs were taken in NHP in the photographic studio of the department.
- Camera: Nikon D30 with 105 mm macro lens mounted on a tripod with the camera parallel to the floor at level with subjects head. Camera to subject distance was standardized at 5 feet.
- A soft white background with millimetric scale printed on it was used for the photography for the standardization of photographs in the ratio of 1:1.

### Photographic Evaluation

- Standardization of photographs was obtained by using a millimetric scale positioned in the background of each photograph.
- The photographs were imported in to Adobe Photoshop, photographs and then printed on Kodak photographic paper.

- 5 photographs from each group were randomly selected and the magnification was observed using the millimetric scale for reference.
- No significant magnification was evident. Tracings done on lead acetate tracing sheets.
- 10 photographs were randomly selected and measured to assess if any intra observer differences existed. No significant differences were found.

### Photographic Evaluation

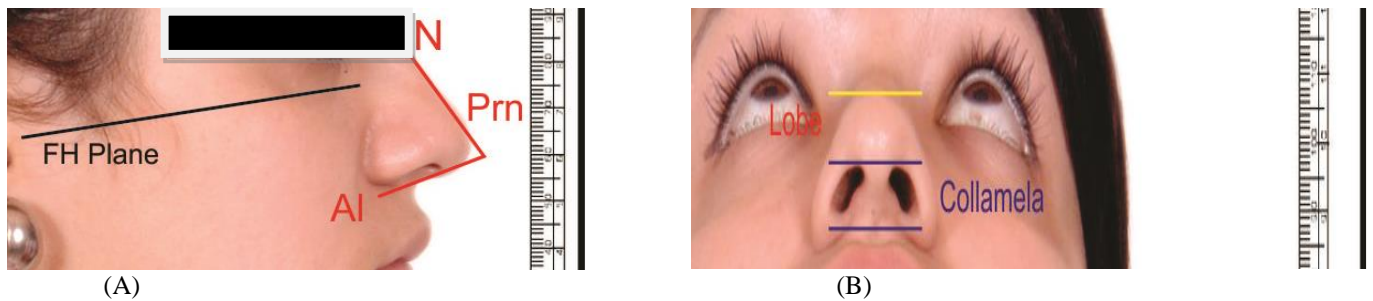
The following evaluations were done

- a) Goode Method[8,9,10]
- b) FomansMethod[11]

Nasal Architecture

Nasal Landmarks ( Fig 1 A and B)

- Line from tip of nose to alar crease
- Line from nasion to nasal tip
- FH plane
- Subnasale
- Collumela
- Lobe of the nose
- Nasal apertures
- Base of the Nose



**Fig 1: landmarks for Esthetic Assessment of the Nose**

1. Profile View: Esthetic Assessment

a. Shape of the dorsum of the nose(Fig 1)

- Normal
- Convex
- Concave

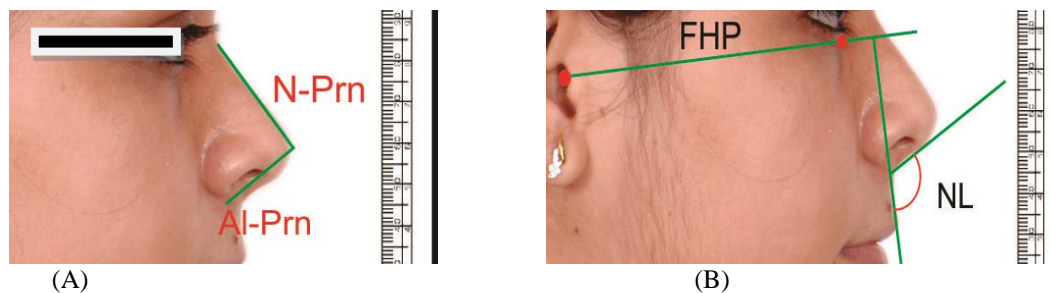
b. Projection of Nose(Fig 2A)

According to Goode, the length of the nose should be about 55%-60% greater than the projection of the nose.

- Length of Nose - Nasion (N) to most prominent point on tip of nose (Prn)
- Depth of Nose – Most prominent point on tip of nose (Prn) to deepest point on Curvature of ala of nose (Al).

c. Rotation of Nasal Tip(Fig: 2 B)

For this measurement a perpendicular was dropped from FHP to Subnasale and tangent of the columella of nose. Angle between tangent of columnar and perpendicular to subnasale was measured to evaluate Nasal Rotation.



**Fig 2 (A, B): Esthetic Assessment of the Nose based on Profile View**

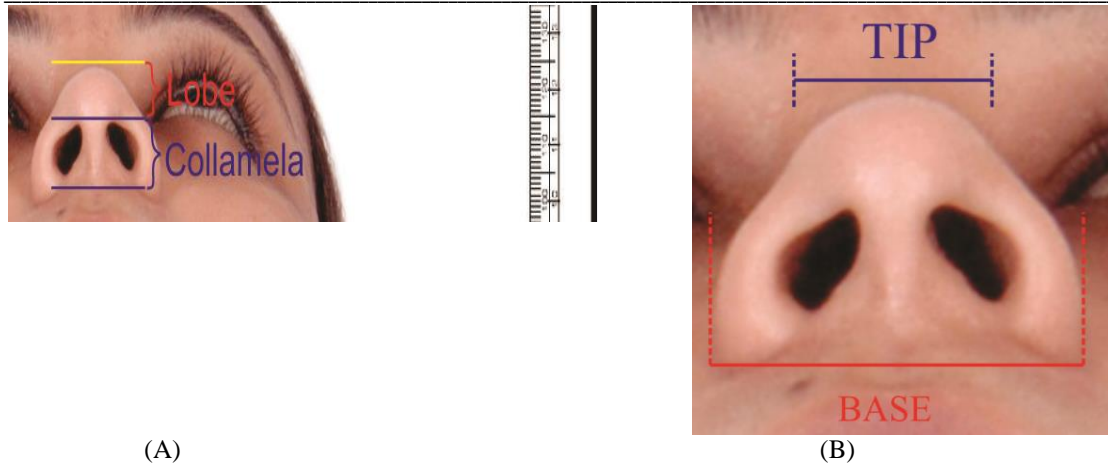
2. IN BASAL VIEW

a. Columella–Lobule Relationship (Fig 3 A)

The basal view of the nose can be divided into thirds with the ratio of the columella to lobule about 2:1. Length of lobe was measured from tip of nose to most anterior point on nasal aperture and length of columella was measured from most anterior point on nasal aperture to the base of nose.

b. Width of Lobule (nasal tip) (Fig 3 B)

- Aesthetically, a narrow nasal tip width, measured as a lobule to nasal base ratio, is preferred. The width of lobule (nasal tip) should be about 35–45% width of the nasal base. Most distal points on nasal lobe represents width of lobe, base of nose were measured by distance between perpendiculars from ala of nose.

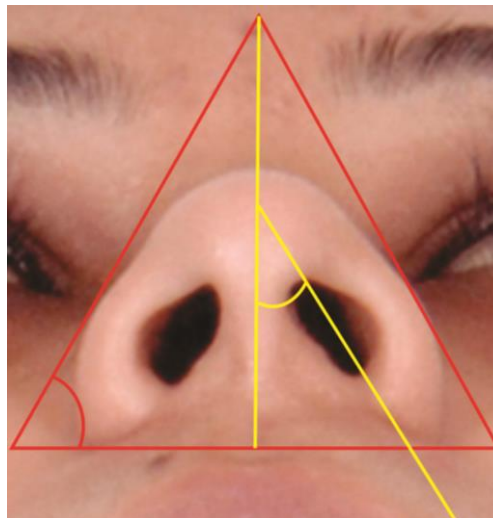


(A)

(B)

**Fig 3 (A, B): Esthetic Assessment of Nose on Basal View**

- c. Alar base should simulate an isosceles triangle, with the lobule neither too broad nor too narrow.(Fig 3C)
- d. Orientation of the Apertures (Fig: 3C)
  - Nasal apertures are usually oriented at an angle of 45–60° to the vertical, although racial variations exist. Angle was drawn from true vertical line and line formed between most anterior and posterior point on nasal aperture.



C)

**Fig 3C: Esthetic Assessment of Nose on Basal View**

#### **Nasal architecture**

Nasal architecture was evaluated on the basis of shape of Nasal Dorsum, Nasal Projection, Nasal Rotation, Ratio of Columella to Lobule, Ratio of Lobule to Nasal Base, Alar base and lobule relationship and Orientation of nasal apertures.

**Table 1: Inter Group Comparison of Nasal Architecture in Three Groups**

Variables	Hilly Region	Mountainous Region	Tarai Region	P-Value for HR, MR, TR	P-Value for HR, MR,	P-Value for HR, TR	P-Value for MR, TR
	(HR)	(MR)	(TR)				
	Mean ± SD	Mean ± SD	Mean ± SD				
Shape of the dorsum	60% ++	55% +	62% +++	.136	-	-	-
Nasal Projection	60% ± 5.50 ++	50% ± 7 +	61% ± 8 +++	.000*	.000*	1.00	.000*
Nasal Tip Rotation	107 <sup>0</sup> ± 7 ++	109 <sup>0</sup> ± 7 +++	103 <sup>0</sup> ± 9 +	.003*	.625	.103	.003*
Columella : Lobule	1.26 ± .332 : 1 ++	1.06 ± .281 : 1 +	1.5 ± .1941 : 1 +++	.000*	.002*	.000*	.000*
Lobule : Nasal Base	48% ± 10 +	48% ± 9 +	48% ± 7 +	.942	1.00	1.00	1.00
Alar base and lobule relationship	80% +	88% ++	80% +	.870	-	-	-
Orientation of nasal apertures	45 <sup>0</sup> ± 8 +	49 <sup>0</sup> ± 7 +++	46 <sup>0</sup> ± 7 ++	.175*	.270*	1.00*	.381*

Inter group comparison of nasal architecture reveals that

- Shape of dorsum: -Convex in all three groups of Nepalese females and there were no significant differences among the groups. Table: 1, Fig: 3 (A)
- Nasal Projection:- Tarai region females had maximum projection of the nose (61% ± 8) followed by Hilly females (60% ± 5.50) and least projection of nose was found in mountainous region females (50% ± 7). Nasal Projection showed no significant difference in hilly and tarai Nepalese females but shows significant difference between hilly and mountainous region and mountainous region and tarai females. Table: 1, Fig: 3 (A)
- Nasal Tip Rotation:-Maximum inclination (Tip Rotation) of nose in mountainous region females (109<sup>0</sup> ± 7) followed by hilly region females (107<sup>0</sup>) but it was least in tarai region females (103<sup>0</sup> ± 9). Nasal tip rotation shows no significant difference between hilly and tarai region Females but there was significant difference in hilly - mountainous region and

mountainous region –tarai region Females. Table: 14, Fig: 19 (B)

- Ratio of Columella to Lobule: - Length of lobe of the nose in relation to columella was largest in tarai region females (1.5 ± .1941: 1) followed by hilly region females (1.26 ± .332: 1) and shortest in mountainous region females (1.06 ± .281: 1). Ratio of Columella to Lobule showed significant difference between all three groups. Table: 1, Fig: 3(C)
- Ratio of Lobule to Nasal Base: -Width of nasal lobe was 48% to nasal base in all three groups of Nepalese females and also showed statistically no significant difference in all three groups. Table: 1, Fig: 19(D)
- Alar Base and Lobule Relationship: -Alar base and lobe of nose form isosceles triangle in 88% of mountainous region females, followed by hilly region and tarai region females (80%) there was no difference in the three groups. Table 14, Fig 19 (E)
- Orientation of Nasal Apertures:- Showed that maximum angle was found in mountainous

region females ( $49^{\circ} \pm 7$ ) followed by tarai region females ( $46^{\circ} \pm 7$ ) and least angulations was found in hilly region females ( $45^{\circ} \pm 8$ ) and also showed statistically no significant difference in all three groups. Table: 14, Fig: 19 (E)

#### Nasal architecture in Nepalese Females

The otolaryngologist is trained to perform rhinoplasty based on aesthetic norms derived from American, European population. Nose is unique in its architecture. Peck and Peck<sup>12</sup> stated that the development of western nasal esthetic is derived from standards developed by the ancient Greeks and scholars and artists of Renaissance period. Later influences on nasal beauty were derived from fashion models and film stars. As literature search revealed no such previous study this dissertation aimed to research the nasal morphology and architecture in females of three Nepalese ethnic groups. The study was also designed to compare the traditional western norms with the nasal features of Nepalese females.

On anterior view, the nose was analyzed subjectively for the shape of the dorsum and classified as convex, straight and concave. When considering the various anatomical relationships of nose, the dorsal profile, tip inclination, rotation of nose from the face, and condition of the nasal base, including the relationship of the columella to the nostril edge was studied and compared with the western norms.

Nasal Tip Projection showed that nasal length is usually defined as the distance from the nasion to the nasal tip. The nasion is the landmark defining the deepest portion of the nasofrontal groove, which should be sufficiently distinct to separate the dorsum from the glabella, or 4 to 6 mm deep. The ideal location for the nasion is at the level of the upper eyelash with the eye in a straight gaze. In this study the nasal tip projection was evaluated by the Goode's method<sup>10</sup> which states that distance between the Alar Facial Crease and Nasal Tip should not be more than the 55% - 65% to the distance between the Nasion and Tip of the Nose.

Tip Rotation is often a controversial esthetic nasal parameter. In some quarters, the term "rotation" refers to a surgical maneuver to alter the inclination of the tip. However, it is more widely accepted that "rotation" can describe the relationship of the nasal base to the facial plane on profile view. The most common way of describing tip rotation is the nasolabial angle. The nasolabial angle is the relationship of the columella to the upper lip. The angle is measured from a line tangent to the most anterior point of the columella to the subnasale, and a line intersecting the subnasale and the mucocutaneous border of the upper lip. As may be

imagined, a dental deformity or a distortion of the maxilla or mandible can cause a marked impact on the nasolabial angle. In addition, an overly prominent or deficient nasal spine or caudal septum may cause a misrepresentation of the true inclination of the nasal tip. Recognizing the deficiencies of measuring the nasolabial angle, some authorities have advocated other methods of assessing tip rotation. Sheen and Sheen<sup>13</sup> described the relationship of the base of the nose with the facial plane. In Caucasians, the vertical plane of the lip tends to be in line with the plane of the face, the facial plane method has its deficiencies, since a prominent or recessive chin would distort accurate assessment of tip rotation. For the same reason, this method is inappropriate for patients under general anesthesia, since the endotracheal tube keeps the mouth open and displaces the chin.

To overcome the deficiencies the method used in this study was that proposed by Foman[14]. A vertical line perpendicular to the Frankfurt horizontal plane passes through the alar-facial angle is drawn. Another line is then drawn through the long axis of the nostril. The angle formed by the intersecting lines is measured. The proposed ideal for this angle varied from  $90^{\circ}$  to  $105^{\circ}$ . In women, angles ranging from  $90^{\circ}$  to  $120^{\circ}$ <sup>14</sup> have been advocated.

The Caucasian norms also states that the width of the nasal base is approximately equal to the distance between the inner canthus of the eyes, which in turn should approximate one eye's width when viewed from below the ideal nose should approximate an equilateral triangle and the columella to lobule relationship should be 2:1 and tip of the nose should be 35% - 45% to the base of the nose in width and the nasal apertures should be oriented at an angle of  $45^{\circ}$ <sup>10</sup> to the true vertical.

#### Nepalese Nose

Peck and Peck<sup>12</sup> reviewed data related to historical art collections and discussed the scientific evaluation of dental occlusions and faces with the Golden Ratio. They pointed out a problem with historical subjects used for the Divine Proportion and also reported that the general public prefers a fuller, more protrusive profile than what the customary cephalometric standards indicate. This study shows that the standards and norms for one population should not always be acceptable for another population and studies of Paula Fernandez-Riveiro<sup>3</sup> shows that there were presence of sexual dimorphism in most parameters of the Labial, Nasal, and Chin areas. There is no study evident in literature which defines the norms or ideal proportions for the Nepalese population, Hence the purpose of this study also was to define the nasal norms for Nepalese females belonging to the three ethnic groups studied. If the norms were common to all ethnic groups a larger

multicentric study would validate the findings of the research.

Evaluation of the nasal architecture in Hilly region females reveals that the shape of the nasal dorsum was straight and projection of the nose was in normal range 60%. Nasal tip was oriented  $107^{\circ}$  to the Frankfort horizontal plane which was also normal, Columella : Lobule relationship showed that Columella was slightly longer than the Lobe. Analysis of Lobule : Nasal Base relationship revealed that Lobe of Nose was slightly wider in comparison to Nasal Base, Alar base and lobule formed an isosceles triangle which revealed that nose was symmetric, Nasal apertures were oriented at an angle of  $45^{\circ}$  in hilly region females.

Evaluation of the nasal architecture in mountainous region females reveals that the shape of the nasal dorsum was straight and nose was under projected 55%. Nasal tip was oriented  $109^{\circ}$  to the Frankfort horizontal plane which was normal, Columella: Lobule relationship showed that Columella was equal in length with the Lobe. Analysis of Lobule : Nasal Base relationship revealed that Lobe of Nose was slightly wider in comparison to Nasal Base, Alar base and lobule formed an isosceles triangle which revealed that nose was symmetric, Nasal apertures were oriented at an angle of  $49^{\circ}$  in hilly region females.

Evaluation of the nasal architecture in tarai region Females reveals that the shape of the nasal dorsum was straight and projection of the nose was in normal range 61%. Nasal tip was oriented  $103^{\circ}$  to the Frankfort horizontal plane which was also normal, Columella : Lobule relationship showed that Columella was longer than the Lobe. Analysis of Lobule : Nasal Base relationship revealed that Lobe of Nose was slightly wider in comparison to Nasal Base, Alar base and lobule formed an isosceles triangle which revealed that nose was symmetric, Nasal apertures were oriented at an angle of  $46^{\circ}$  in hilly region females.

Evaluation of the nasal architecture in all three Nepalese Females reveals that the shape of the Nasal Dorsum was Straight in all three groups of Nepalese females, Nasal Projection was similar in hilly and tarai region females but mountainous region females had slightly under projected Nose in comparison to the other Nepalese ethnic groups. Nasal Tip was similarly oriented to the Frankfort horizontal plane in all three groups of Nepalese females, Columella to Lobe relationship shows completely different trend Columella was Longest in tarai region females (1.5:1) followed by hilly region females (1.26:1) and Shortest in mountainous region females (1.06:1). Lobe: Nasal base relationship reveals that Lobe: Nasal base relationship were similar in all three groups. Alar base and lobule relationship should form the isosceles

triangle and majority noses forms the isosceles triangle in all three groups of Nepalese females. Hilly and tarai region females showed similar orientation of the nasal apertures ( $45^{\circ}$ ,  $46^{\circ}$ ) but mountainous region females showed wider orientations of the nasal apertures ( $48^{\circ}$ ). Analysis of nasal architecture reveals that mountainous region nose were shorter and broader than hilly and tarai region females

## Conclusion

1. Evaluation of nasal architecture reveals that shape of nasal dorsum was straight in all three groups of Nepalese females studied. Nasal Projection was similar in Tarai and hilly females but mountainous females had slightly under projected nose.
2. Nasal tip was similarly oriented to the Frankfort horizontal plane in all three groups of Nepalese females, Columella to Lobe relationship showed that Columella was longest in tarai region females followed by hilly region females and shortest in mountainous region females.
3. Alar base and Lobule relationship formed an Isosceles Triangle in all three groups of Nepalese. hilly and tarai region females showed similar orientation of the Nasal apertures but mountainous region females showed wider orientations of the Nasal apertures.
4. The findings of research could give the orthodontist / orthognathic / plastic surgeon a starting reference for various esthetic nasal surgeries and modifications for nepalese ethnic groups studied.
5. Null hypothesis was rejected and alternative hypothesis accepted which said the presence of geometric and mathematical relationship was present in the nasal architecture of female population of three ethnic groups of Nepal .

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