

Evaluation of Nasolabial Angle – A Cephalometric Study in Nepalese Adults with Normal Occlusion and Pleasing Facial Profile Visiting A Tertiary Level Hospital

Dr. Ravi Kumar Mahto¹, Dr. Dashrath Kafle², Dr. Diwash Rai³, Dr. Rabina Sakha⁴, Dr. Nikita Rajbhandari⁵

¹Assistant Professor, ²Professor and Head, Department of Orthodontics & Dentofacial Orthopedics, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal

^{3,4,5}Former Dental Undergraduate Student, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal

Corresponding author: Dr. Ravi Kumar Mahto; Email: drravimahto@gmail.com

ABSTRACT

Introduction: Evaluation of nasolabial angle and its two associated components i.e. inclination of nose and upper lip is vital in orthodontic diagnosis and treatment planning. The normal value for these angular parameters has been found to vary in studies done previously in different populations.

Aims and Objectives: The present study aimed to obtain normative value for nasolabial angle and its components as well as to study variation of these angular parameters in Nepalese adult male and female subjects with normal occlusion and pleasing facial profile.

Materials and Method: Lateral cephalogram of 46 adult subjects (21 males and 25 females) with Class I occlusion and pleasing profile were selected from the archives of Department of orthodontics, Dhulikhel Hospital. Manual tracing and measurement of nasolabial angle (NLA) and 2 related parameters that affects nasolabial angle i.e., lower border of nose to Frankfort horizontal plane angle (N/FH), upper lip to Frankfort horizontal plane angle (L/FH) were done. Descriptive analysis was carried out and Student's t-test was used to compare mean differences between the male and female subjects.

Result: The mean values of NLA, N/FH and L/FH were 100.22 ± 10.36 , 22.78 ± 7.46 and 79.46 ± 8.29 respectively. The mean value of NLA was 100.48 ± 10.07 in male subjects and 103.68 ± 10.57 in female subjects. Similarly, the mean value of N/FH was 21.90 ± 6.65 for males and 23.52 ± 8.14 for females. Also, the mean value of L/FH was found to be 78.62 ± 7.39 for males and 80.16 ± 9.07 for females.

Conclusion: Normative value of nasolabial angle and its two associated parameters was established. Also, sexual dimorphism was observed with mean values of all the 3 parameters higher in female subjects as compared to male subjects.

KEYWORDS: Lateral cephalogram, Nasolabial angle, Nepalese adult orthodontic subjects, Normal occlusion

INTRODUCTION

Achievements of harmonious and balanced face with optimal functional occlusion are the primary and secondary goals of contemporary orthodontic treatment respectively. Hence an increased emphasis is given on soft tissue evaluation during diagnosis and treatment planning of patients seeking orthodontic treatment

and /or orthognathic surgery. Out of numerous soft tissue parameters, nasolabial angle is one of the most commonly used parameter for evaluating soft tissue profile. Apart from this, it has huge influence on orthodontist's decision to extract or not extract the teeth during orthodontic treatment¹⁻³. Over the years, various authors have established the normative

value of nasolabial angle. Variation in the value can be attributed to racial variation as well as difference in the method of constructing the nasolabial angle. Also sexual dimorphism for nasolabial angle have been observed in these studies.⁴⁻⁹

Hence, a population and gender specific normative data must be available to clinician for diagnosing and formulating a correct treatment plan for orthodontic patients. However, we could not found any published study evaluating nasolabial angle in Nepalese adult orthodontic subjects when a electronic literature search using key words “nasolabial angle”, “normal occlusion” and “Nepalese adult orthodontic subjects” was done. Hence, the present study was undertaken to study variation of nasolabial angle among Nepalese adult male and female subjects with normal occlusion and well balanced face visiting a tertiary level hospital in Central Nepal.

MATERIALS AND METHOD

Ethical approval for the study was taken from Institutional Review Committee, Kathmandu University School of Medical Sciences (IRC no: - 83/2021). A total of 46 lateral cephalogram of adult subjects (21 males and 25 females) between 18 to 32 years were selected from the archives of the Department of Orthodontics, Dhulikhel Hospital according to the following criteria.

Inclusion Criteria:

- Good quality lateral cephalogram of Nepalese adult subjects with aesthetically pleasing profile and Class I occlusion.
- Cephalograms with subjects in natural head position and their lips relaxed.
- Cephalograms of subjects with all 28 permanent teeth present. The presence or absence of third molars was not considered essential.

Exclusion Criteria:

- Cephalograms of subjects who had undergone orthodontic treatment and or craniofacial surgery.

Lateral cephalogram of each subject were traced manually using standard protocol. A total of 4 commonly used anatomical landmarks were plotted on each cephalogram (Figure 1). Using protractor 3 angular parameters (Figure 1 and Table 1) were measured to the nearest 0.5 degree respectively. To avoid intraobserver bias all the assessments (tracing as well as measurement) were done by the same investigator

(RKM). Also, only five cephalograms were analyzed daily to minimize errors due to the human fatigue. To evaluate the errors due to landmark identification, tracing and measurement, 15 cephalograms were randomly selected. After three weeks gap, all the landmarks were replotted. Manual tracing and measurements were repeated on these cephalograms.¹⁰

Statistical Analysis

All the statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) (version 21.0; IBM, Armonk, NY, USA). Intraclass correlation coefficient (ICC) was done to determine intra-observer reliability and reproducibility for repeated measurements. Normality of data distribution was checked using Shapiro-Wilk test. Descriptive analysis was carried out for all angular parameters. The mean and standard deviation (SD) for all angular parameters of all cephalometric measurements were calculated for both sexes. Differences in the mean were analyzed using Student's t-test with level of significance set at $p < 0.05$ to study sexual dimorphism.

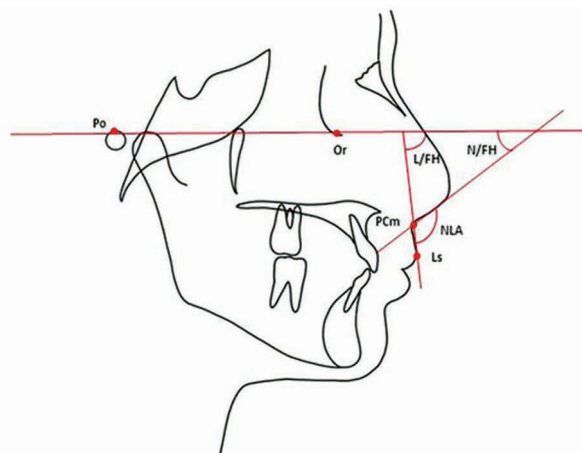


Figure 1. Cephalometric landmarks and lines used in the study: [Po:Porion (most superior point on external auditory meatus), Or:Orbitale (lowest point on the inferior margin of the orbit), PCm:Posterior columella point(most posterior point of the lower border of the nose at which it begins to turn inferiorly to merge with the philtrum of the upper lip),Ls:Labrale superius(a point indicating the mucocutaneous border of the upper lip), PCm tangent line:a tangent drawn from PCm anteriorly along the lower border of nose at its approximate middle third) PCm-Ls line:line drawn from PCm to Ls.

Cephalometric parameters used in the study: Lower border of nose to Frankfort horizontal plane angle(N/FH), Upper lip to Frankfort horizontal plane angle(L/FH) and Nasolabial angle(NLA)]

Table 1: Cephalometric Parameters (Angular) used in the study

S.No.	Parameters (Angular)	Description
1.	Lower border of nose to Frankfort horizontal plane angle(N/FH)	Postero-inferior angle formed by the PCm tangent line extending anteriorly and intersecting the Frankfort horizontal plane
2.	Upper lip to Frankfort horizontal plane angle(L/FH)	Antero-inferior angle formed by the PCm-Ls line extending anteriorly and intersecting the Frankfort horizontal plane
3.	Nasolabial angle(NLA)	Antero-inferior angle formed by the intersection of PCm tangent and the PCm-Ls line

RESULTS

ICC values for repeated cephalometric measurements were > 0.9 indicative of very high intra-observer reliability.^{11,12} Mean, standard deviation and range for 3 angular parameters are presented in Table 2. The mean values of nasolabial angle (NLA), lower border of nose to Frankfort horizontal plane angle (N/FH) and upper lip to Frankfort horizontal plane angle (L/FH) were 100.22± 10.36, 22.78 ± 7.46 and 79.46 ± 8.29 respectively. The mean value of NLA was 100.48 ± 10.07 in male subjects and 103.68 ± 10.57 in female subjects. Similarly, the mean value of N/FH was 21.90 ± 6.65 for males and 23.52 ± 8.14 for females. Whereas, the mean value of L/FH was found to be 78.62 ± 7.39 for males and 80.16 ± 9.07 for females. The mean values of all the 3 parameters were found higher in female subjects as compared to male subjects. However, the difference between the mean values was statistically insignificant. (Table 3)

Table 2: Mean, standard deviation and range for different parameters used in the study

Variable	Mean ± SD	Range
Nasolabial angle (NLA)	102.22 ± 10.36	76.0 - 124.0
Lower border of nose to Frankfort horizontal plane angle (N/FH)	22.78 ± 7.46	9.0 - 47.0
Upper lip to Frankfort horizontal plane angle (L/FH)	79.46 ± 8.29	65.0 - 97.0

SD, Standard deviation

Table 3: Comparison of mean value for different parameters used in the study between male and female subjects

Variable	Group	N	Mean	SD	P value†
Nasolabial angle (NLA)	Male	21	100.48	10.07	0.30
	Female	25	103.68	10.57	
Lower border of nose to Frankfort horizontal plane angle (N/FH)	Male	21	21.90	6.65	0.47
	Female	25	23.52	8.14	
Upper lip to Frankfort horizontal plane angle (L/FH)	Male	21	78.62	7.39	0.54
	Female	25	80.16	9.07	

SD, Standard deviation; †Student’s t-test

DISCUSSION

Nasolabial angle is formed by intersection of two lines, one represents inclination of the lower border of nose while the other represents inclination of the upper lip, both independent of each other. Measurement of nasolabial angle alone can be inadequate and misleading as it does not provide information about the abnormal component i.e. the nose, lip or both. Despite having proclined upper incisors and lips, a patient can have normal nasolabial angle due to increase in the inclination of nose. Hence, measurement of nasolabial angle along with its two associated components (inclination of the lower border of nose and inclination of the upper lip) is a must for orthodontist while making orthodontic diagnosis and formulating a treatment plan.

A variation in the normal value of nasolabial angle can be observed in previous studies. Racial variation and differences in the method of constructing the nasolabial angle can be accounted for this variation. Also sexual dimorphism for nasolabial angle can be seen in these studies. A population specific normative data can help clinician to correctly diagnose and formulate ideal treatment plan for a case.

Because a uniform method for drawing nasolabial angle was lacking, Fitzgerald JP et al⁷ developed a reliable and reproducible three – step approach to construct nasolabial angle. Hence, we used the method proposed by Dr. Jay P Fitzgerald in this study. Fitzgerald JP et al⁷ in their study done in white adults having Class I occlusion and well balanced faces found that the mean value of nasolabial angle (NLA) was 114.08 ± 9.58. While, Dua V et al¹³ and Nandini S et al¹⁴ in similar

studies conducted in Indian population found that the mean value of nasolabial angle (NLA) was 96.10 ± 9.7 and 98.10 ± 10.75 respectively. Based on our results, we found that the mean values of NLA for Nepalese adults was 100.22 ± 10.36 which lies in between the Indian and white population.

The mean value of lower border of nose to Frankfort horizontal plane (N/FH) angle was found to be 17.76 ± 7.40 , 17.06 ± 8.0 and 17.42 ± 8.40 by Fitzgerald JP et al⁷, Dua V et al¹³ and Nandini S et al¹⁴ respectively. These values were less in comparison to our values i.e. 22.78 ± 7.46 . Whereas the mean value of upper lip to Frankfort horizontal plane (L/FH) angle in our sample was found to be 79.46 ± 8.29 which was less than the values given by Fitzgerald JP et al⁷ and Nandini S et al¹⁴ i.e. 97.85 ± 5.26 and 80.68 ± 6.45 respectively and higher than given by Dua V et al¹⁰ i.e. 78.76 ± 9.6

In addition to it, we found that mean values of all the 3 parameters were higher in female subjects as compared to male subjects. However, the difference between the mean values were statistically insignificant. These findings were similar to the results of study by Fitzgerald JP et al⁷. On the other hand, Dua V et al¹³ based on their results concluded that males had higher mean values as compared to female subjects for these parameters with no statistically significant difference between them.

LIMITATION AND FUTURE SUGGESTIONS

In the present study pre-treatment lateral cephalogram of 46 orthodontic patients with Class I occlusion and esthetic facial profile visiting a tertiary level hospital in Central Nepal were evaluated and normative data for nasolabial angle and its 2 associated parameters were obtained. This study sample may not be a complete representation of Nepalese population. Hence future studies with a larger sample size which includes different ethnic groups are suggested.

CONCLUSION

The mean values of nasolabial angle (NLA), lower border of nose to Frankfort horizontal plane angle (N/FH), upper lip to Frankfort horizontal plane angle (L/FH) of nepalese adults were found to vary in comparison to other population. Also, the mean values of all the 3 parameters were found higher in female subjects as compared to male subjects. Hence, a population and gender specific normative data for nasolabial angle and its associated components must be available for correct orthodontic diagnosis and treatment planning.



REFERENCES

1. Proffit W R, Fields HW, Sarver DM. Contemporary Orthodontics 4th Edition, St. Louis: MOSBY ELSEVIER;2007.
2. Arnett GW, Bergman RT. Facial keys to orthodontic diagnosis and treatment planning–Part II. Am J Orthod Dentofac Orthop. 1993; 103(5):395-411.
3. Sarver DM. Interactions of hard tissues, soft tissues, and growth over time, and their impact on orthodontic diagnosis and treatment planning. Am J Orthod Dentofac Orthop. 2015; 148(3):380-6.
4. Scheideman GB, Bell WH, Legan HL, Finn RA, Reisch JS. Cephalometric analysis of dentofacial normals. Am J Orthod 1980;78(4):404-20.
5. Shalhoub SY, Sarhan OA, Shaikh HS. Adult cephalometric norms for Saudi Arabians with a comparison of values for Saudi and North American Caucasians. Br J Orthod. 1987;14(4):273-9.
6. Nanda RS, Meng H, Kapila S, Goorhuis J. Growth changes in the soft tissue facial profile. Angle Orthod. 1990;60(3):177-90.
7. Fitzgerald JP, Nanda RS, Currier GF. An evaluation of the nasolabial angle and the relative inclinations of the nose and upper lip. Am J Orthod Dentofac Orthop. 1992; 102(4):328-34.
8. Miyajima K, McNamara JA Jr, Kimura T, Murata S, Iizuka T. Craniofacial structure of Japanese and European-American adults with normal occlusions and well-balanced faces. Am J Orthod Dentofacial Orthop. 1996 Oct;110(4):431-8.
9. Magnani MBBA, Nouer DF, Nouer PRA, Pereira Neto JS, Garbui IU, Böeck EM. Assessment of the nasolabial angle in young Brazilian black subjects with normal occlusion. Braz Oral Res 2004;18(3):233-7.
10. Mahto RK, Kharbanda OP, Duggal R, Sardana HK. A comparison of cephalometric measurements obtained from two computerized cephalometric softwares with manual tracings. J Indian Orthod Soc. 2016;50(3):162-170.
11. Fayers P, Hays R. Assessing Quality of Life in Clinical Trials. 2nd ed. Oxford University Press; 2005:114-127.
12. Tsorvas G, Karsten AL. A comparison of hand-tracing and cephalometric analysis computer programs with and without advanced features—accuracy and time demands. Eur J Orthod. 2010;32(6):721-728.
13. Dua V, Gupta S, Singh C. Evaluation of the nasolabial angle in the Indian population. Contemp Clin Dent. 2010; 1(2):79-82.
14. Nandini S, Prashanth CS, Somiah SK, Reddy SR. An evaluation of nasolabial angle and the relative inclinations of the nose and upper lip. J Contemp Dent Pract. 2011; 12(3):152-7.