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

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

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 between male and female subjects

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

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 al\(^7\) 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 al\(^7\) 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 al\(^13\) and Nandini S et al\(^14\) 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 al\(^7\), Dua V et al\(^13\) and Nandini S et al\(^14\) 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 al\(^7\) and Nandini S et al\(^14\) i.e. 97.85 ± 5.26 and 80.68 ± 6.45 respectively and higher than given by Dua V et al\(^13\) 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 al\(^7\). On the other hand, Dua V et al\(^13\) 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**